



**Weston Solutions, Inc.**  
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SUPERFUND TECHNICAL ASSESSMENT & RESPONSE TEAM V  
EPA CONTRACT NO.: 68HE0319D0004

October 10, 2019

Mr. Peter Lisichenko, On-Scene Coordinator  
U.S. Environmental Protection Agency, Region II  
Superfund and Emergency Management Division  
2890 Woodbridge Avenue  
Edison, New Jersey 08837

**EPA CONTRACT No: 68HE0319D0004**

**TDD No: 0033**

**DC No: STARTV-01-D-0089**

**SUBJECT: SITE-SPECIFIC HEALTH AND SAFETY PLAN  
NIAGARA FALLS BOULEVARD RADIOLOGICAL SITE  
NIAGARA FALLS, NIAGARA COUNTY, NEW YORK**

Dear Mr. Lisichenko,

Enclosed please find the Site-Specific Health and Safety Plan (HASP), for the Removal Action to be performed at the Niagara Falls Boulevard Radiological Site (the Site) located in Niagara Falls, Niagara County, New York. This plan covers the soil sampling and air monitoring activities to be conducted at the Site beginning October 14, 2019.

If you have any questions or comments, please do not hesitate to contact me at (732) 585-4413.

Sincerely,

WESTON SOLUTIONS, INC.

*For:* Bernard Nwosu  
Site Project Manager

Enclosure:  
cc: TD File: TO-032-1033

*an employee-owned company*



In association with Eco-Risk, Pro-West, Associates, Inc., Avatar Environmental, LLC,  
On-Site Environmental, Inc., and Sovereign Consulting, Inc.

**SITE-SPECIFIC HEALTH AND SAFETY PLAN**  
**NIAGARA FALLS BOULEVARD RADIOLOGICAL SITE**  
Niagara Falls, Niagara County, New York

SSID No.: A23Q  
EPA ID No.: NYN000206699

Prepared by:

Superfund Technical Assessment & Response Team V  
Weston Solutions, Inc.  
Federal East Division  
Edison, New Jersey 08837

Prepared for:

U.S. Environmental Protection Agency, Region II  
Superfund and Emergency Management Division  
2890 Woodbridge Avenue  
Edison, New Jersey 08837

DC No: STARTV-01-D-0089  
TD No: TO-032-0033  
EPA CONTRACT No: 68HE0319D0004

October 2019

**REGION II START V HEALTH AND SAFETY PLAN**  
**EMERGENCY RESPONSE/REMOVAL ASSESSMENT/REMOVAL ACTION**  
**(Revised 11 July 2017)**

**START V TDD No.:** TO-0032-0033      **Site Name:** Niagara Falls Boulevard Radiological Site

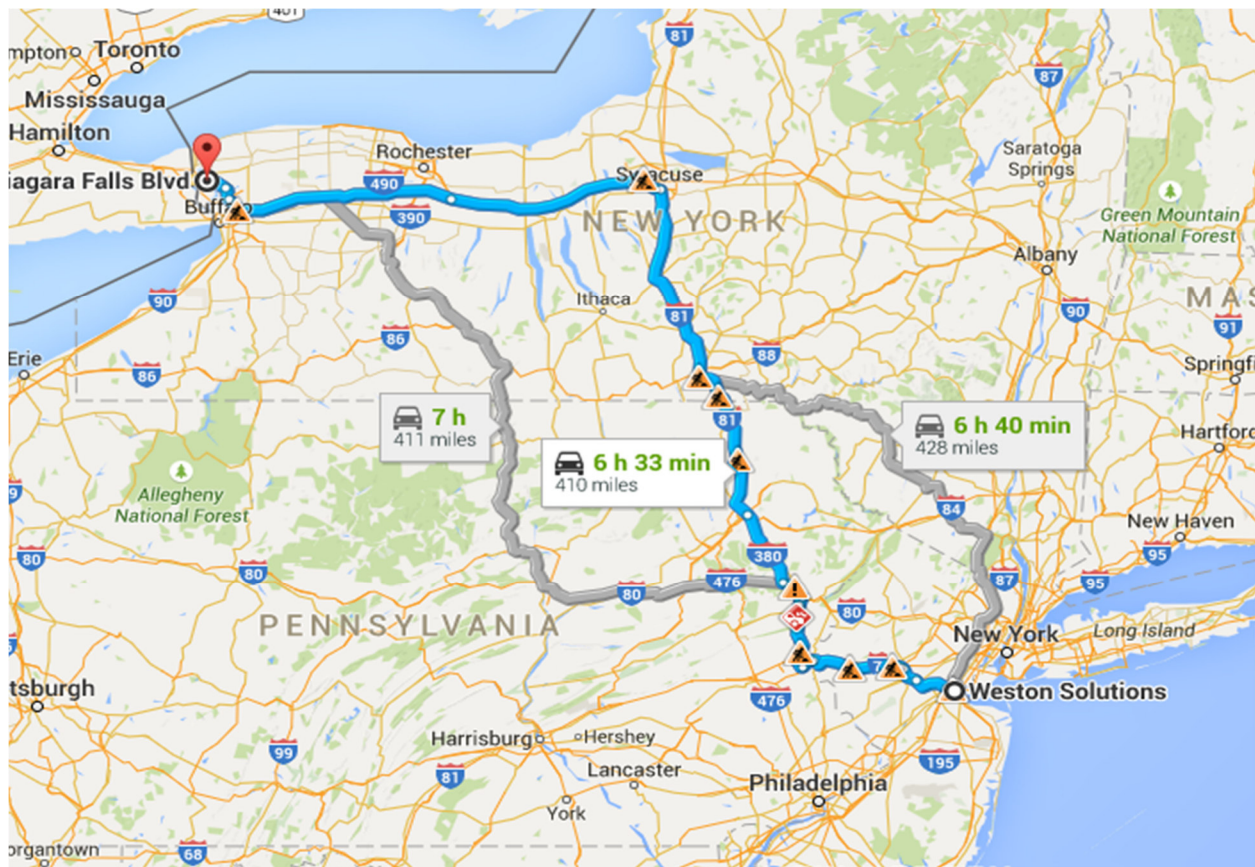
**Site Address:** Street: 9540 Niagara Falls Boulevard

City/State: Niagara Falls, New York

**Directions to Site:** (Attach Color Map Following This Page)

1. Head **southwest** on **King Georges Post Rd** toward **Clearview Rd** 0.6 mi
2. Turn **right** onto **Raritan Center Pkwy** 256 ft
3. Keep **right** at the fork, follow signs for **Middlesex County 514 E/Woodbridge Ave/I-287/NJ-440** and merge onto **Woodbridge Ave** 0.4 mi
4. Use the right lane to take the ramp onto **I-287 N** 0.8 mi
5. Merge onto **I-287 N** 2.1 mi
6. Keep **left** to stay on **I-287 N** 11.9 mi
7. Keep **right** to stay on **I-287 N** 6.3 mi
8. Use the left 2 lanes to take exit **21 b** toward **I-78 W/Easton PA** 1.5 mi
9. Merge onto **I-78 W** 31.0 mi
10. Keep **left** to stay on **I-78 W** 4.6 mi
11. Take exit **71** for **PA-33 N** toward **US-22/Stroudsburg** 0.4 mi
12. Continue onto **PA-33 N** 22.4 mi
13. Continue onto **PA-33N/US-209 N** 2.0 mi
14. Keep **left** to continue on **PA-33/Hwy 33 N**, follow signs for **W Interstate 80/Bartonsville/Hazelton** 3.1 mi
15. Use the left lane to merge onto **I-80 W** toward **Hazelton** 9.0 mi
16. Keep **right** at the fork to continue on **I-380 N**, follow signs for **Scranton** 27.8 mi
17. Keep **right** to continue on **I-380 N/I-84**, follow signs for **US-6 W/I-81 N/PA-347/Binghamton** 0.5 mi
18. Merge onto **I-81 N** 58.1 mi
19. Keep **right** at the fork to stay on **I-81 N**, follow signs for **I-88/Syracuse/Albany** 71.8 mi
20. Take the exit onto **I-690 W** toward **Fairgrounds/Baldwinsville** 7.7 mi
21. Keep **left** to stay on **I-690 W** 0.9 mi
22. Continue onto **NY-690 N** 0.2 mi
23. Take exit **1** to merge onto **I-90 W** 61.9 mi
24. Keep **left** to stay on **I-90 W** 69.0 mi
25. Take exit **50** for **I-290** toward **Niagara Falls** 0.4 mi
26. Continue onto **I-290 W** 4.5 mi
27. Use the right 2 lanes to take exit **3** for **US 62/Niag Falls Blvd** 0.3 mi
28. Use the right 2 lanes to turn **right** onto **US-62 N/Niagara Falls Blvd** 4.0 mi
29. Continue straight to stay on **US-62 N/Niagara Falls Blvd**; destination will be on **Right** 6.8 mi

**Total Distance: 410 miles; Total Time: Approximately 6 hours, 33 minutes**



*This map is subject to Google's Terms of Service, and Google is the owner of rights therein.  
Portions of this image have been removed for clarity.*

### **Historical/Current Site Information:**

The Niagara Falls Boulevard Radiological Site (the Site) is located in a mixed commercial and residential area of Niagara Falls, New York. The Site consists of two parcels, namely 9524 and 9540 Niagara Falls Boulevard and it encompasses approximately 2.53 acres. Currently, the 9524 Niagara Falls Boulevard property contains a bowling alley and an asphalt parking lot; the 9540 Niagara Falls Boulevard property is occupied by a hardware store, Greater Niagara Building Center, Inc. (GNBC) and an asphalt parking lot. The properties are bordered to the north by a wooded area; to the east by a church; to the south by Niagara Falls Boulevard, beyond which is a residential area; and to the west by a hotel and residential area.

In 1978, the U.S. Department of Energy (DOE) conducted an aerial radiological survey of the Niagara Falls region and identified more than 15 properties having elevated levels of radiation above background levels. It is believed that, in the early 1960s, slag from an unknown source was used as fill on the properties prior to paving. Based on the original survey and subsequent investigations, it is believed that the radioactive slag was deposited on the Site.

In September/October 2006 and May 2007, the New York State Department of Environmental Conservation (NYSDEC) conducted radiological surveys of the interior and exterior of both properties on several occasions using gamma detectors, Exploranium-135, and Ludlum Model 2221 Ratemeter/Scaler (Ludlum-2221). With the exception of an office area and storage space at 9540 Niagara Falls Boulevard that was constructed after the original building directly on top of the asphalt parking lot, interior radiation levels obtained with Exploranium-135 were relatively low. The highest reading in the newer area was 115 microrentgen per hour ( $\mu\text{R/hr}$ ); elsewhere throughout the building, radiation levels generally ranged between 10 and 20  $\mu\text{R/hr}$ . Exterior

readings taken at waist height generally ranged between 10 and 350  $\mu\text{R/hr}$ , while the maximum reading of 600  $\mu\text{R/hr}$  was recorded at contact (*i.e.*, at the ground surface). At a fenced area behind the building located at 9540 Niagara Falls Boulevard, waist-high readings ranged between 200 and 450  $\mu\text{R/hr}$ , and at-contact readings ranged between 450 and 750  $\mu\text{R/hr}$ . Elevated readings were also observed on the swath of grass between the 9524 Niagara Falls Boulevard property and the adjacent property to the west that contains a hotel, and in the marshy area beyond the parking lot behind the buildings. Two biased samples of slag were collected from locations that exhibited elevated static Ludlum-2221 readings: one slag sample collected from an area of loose blacktop indicated a reading of 515,905 counts per minute (cpm) and the second slag sample collected in the marshy area indicated a reading of 728,235 cpm.

During a reconnaissance performed by the New York State Department of Health (NYSDOH) and NYSDEC on July 9, 2013, screening activities with a hand-held pressurized ion chamber (PIC) unit around an area of broken asphalt indicated gamma radiation levels at 200  $\mu\text{R/hr}$  and 500  $\mu\text{R/hr}$  from a soil pile containing slag at the Site. Readings over 600,000 cpm were recorded with a sodium iodide scintillator from the soil and slag pile.

On September 10, 2013, the U.S. Environmental Protection Agency (EPA) and Weston Solutions Inc., Site Assessment Team (SAT), conducted gamma radiation screening of the 9524 Niagara Falls Boulevard property using Ludlum-2221. On December 4 through 7, 2013, further radiological survey information was obtained from the 9524 and 9540 Niagara Falls Boulevard properties, as well as the church property located further east of the two site parcels. The highest gamma radiation screening results were recorded from the exposed soil area in the rear northern portion of the 9540 Niagara Falls Boulevard property. SAT documented and delineated the areas of observed contamination at the Site by measuring the gamma exposure rates and determining where the gamma exposure rate around the source equaled or exceeded two times (2x) the site-specific background gamma exposure rates. An area of the Site, approximately 168,832 square feet (sq. ft.), indicated gamma radiation levels exceeding 2x the background measurement of 8,391 cpm.

In December 2013, SAT utilized the hollow-stem auger drilling method to collect a total of 16 soil samples, including one field duplicate, and three slag samples from 15 boreholes advanced throughout the Site and on the First Assembly Church property. The two soil samples collected on the First Assembly Church property were to document background conditions. At each sample location, soil samples were collected directly beneath slag; at locations where slag was not present, the soil sample was collected at the equivalent depth interval. Laboratory analytical results indicated concentrations of radionuclides found in the slag and soil samples to be significantly higher than at background condition.

In July 2015, EPA with the support of Weston Solutions Inc., Removal Support Team 3 (RST 3) conducted a Removal Assessment of the Site in order to delineate areas of observed contamination by comparing gamma measurements from suspected source areas with measurements obtained from a background location. Interior ground radiological survey of on-site properties, including 9524 Niagara Falls Boulevard and 9540 Niagara Falls Boulevard, and exterior ground radiological survey of the Site and an off-site background location at the church property on 9750 Niagara Falls Boulevard was conducted. Utilizing a Ludlum Model 2241 Ratemeter/Scaler and a sodium iodide (NaI) 2x2 detector, gamma measurements collected by RST 3 in the one building at 9524 Niagara Falls Boulevard indicated exposure rates ranging from 6,400 cpm around the pin setter area to 45,000 cpm (more than 5x above background) in the rear vestibule. Gamma exposure rates in most areas of the building at 9524 Niagara Falls Boulevard were generally above background. Gamma readings in the one building at 9540 Niagara Falls Boulevard ranged from 6,200 cpm in

the showroom to 200,000 cpm (more than 23x above background) in one storage room located southwest of the building. Generally, gamma exposure rates in most areas of the building at 9540 Niagara Falls Boulevard varied from background to several times above the background. Gamma survey conducted in exterior areas throughout the Site, including asphalt-paved and unpaved areas of both 9524 Niagara Falls Boulevard and 9540 Niagara Falls Boulevard, indicated exposure rates ranging from 10,500 cpm to 600,000 cpm (more than 70x above background). Outdoor gamma readings were generally more than 2x background.

In August 2015, RST 3 conducted additional Removal Assessment soil sampling and radiological survey of exterior locations in order to verify potential releases of radiation-containing materials in soil and fill material associated with slag deposits on-site, determine additional radiation source areas, and delineate the extent of radiological contamination at the Site. Analytical results indicated concentrations of radium-226 (Ra-226) above the EPA Site-Specific Action Level of 2.48 picocuries per gram (pCi/g) in the soil samples.

In May 2017, RST 3 performed additional soil sampling at 20 test pit locations throughout the Site. A total of 88 soil samples were collected from all the test pits at 6-inch intervals below ground surface (bgs) up to a depth of 48 inches bgs, depending at what depth the native confining clay layer was encountered. The soil sampling event was conducted to further verify the vertical extent of potential releases of radiation-containing materials in soil and delineate the extent of the on-site radiological contamination. Analytical results indicated concentrations of Ra-226 above the EPA Site-Specific Action Level of 2.48 pCi/g in 32 of the soil samples.

In May 2018, RST 3 provided field sampling support to EPA's Emergency and Rapid Response Services (ERRS) contractor, Guardian Environmental Services (GES), with collecting 43 soil samples from 13 test pit locations throughout the Site for transportation and disposal cost purposes. Test pits were advanced to depths up to 48 inches bgs. ERRS restored all the test pit locations to their original condition and the samples were shipped to ERRS-procured laboratory for disposal analysis.

In September 2018, RST 3 provided site activity oversight, keeping daily records of site operations through photographic documentation and notations in the Site log book. Additionally, RST 3 conducted community air monitoring for particulates (dust) using DataRAM particulate air monitors, air sampling for radioactive particulates using RADēCO volumetric air samplers with filter media attachment, and post-excavation soil sampling.

#### **START V Scope of Work:**

As part of Removal Action activities at the Site, Superfund Technical Assessment and Response Team V (START V) has been tasked by EPA with providing support for site activities oversight, keeping daily records of site operations through photographic documentation and notations in the Site log book, tracking items that are moved from the building supply center to a temporary location, conducting radiological screening of soil, trenches, and trucks based on appropriate methods determined by the EPA health physicist, and post-excavation soil sampling.

In addition, START V is to conduct community air monitoring for particulates (dust) using DataRAM particulate air monitors, air sampling for radioactive particulates using RADēCO volumetric air samplers with filter media attachment, and post-excavation soil sampling.

Air monitoring and sampling will begin upon initiation of intrusive site excavation and truck loading, and periodically as needed, depending on changes in site conditions, and will consist of continuous real-time air quality monitoring and data collection. Monitoring locations will be

upwind, at areas of intrusive site activity, and downwind. The monitoring stations will be linked via a VIPER system (a wireless network-based communications system) which will provide instantaneous real-time air quality readings through a computer server. The air monitoring data generated will assist in determining if the dust suppression measures being utilized on-site are effective at maintaining dust levels below the Site-Specific Action Levels. The RADēCO volumetric air samplers will be deployed at each air monitoring station to collect ambient air samples which will be analyzed on-site for radioactive dust particles by the EPA health physicist using a Ludlum (Model 3030) Alpha Beta counter. Analytical results of air samples will be used to confirm the effectiveness of dust suppression measures and to ensure site personnel and nearby residences are not being exposed to site-related airborne contaminants. Post excavation soil samples will be collected for on-site analysis for gamma emitting radionuclides utilizing a High Purity Germanium (HPGe) analyzer.

**Three (3) S.M.A.R.T. Health and Safety Goals for the Project (Simple, Measurable, Actionable, Reasonable, & Timely):**

1. Safe operation of vehicles while traveling to and from the Site.
2. Adherence to the Weston Solutions, Inc., Radiation Safety Program during on-site activities, including the usage of time, distance, and shielding to limit radiation exposure.
3. Appropriate personal protective equipment (PPE) will be utilized throughout Site activities.

**Incident Type:**

- ☐ Emergency Response
- ☐ Removal Assessment
- ☒ Removal Action: Beginning week of October 14, 2019
- ☐ Residential Sampling/Investigation
- ☐ RP Oversight
- ☐ Other

**Location Class:**

- ☐ Industrial
- ☒ Commercial
- ☒ Urban/Residential
- ☐ Rural

U.S. EPA OSC: Peter Lisichenko  
 Original HASP: No, Revision 5  
 Lead START V: Bernard Nwosu

Date of Initial Site Activities: 6/1/2016  
 Site Health & Safety Coordinator: Bernard Nwosu  
 Site Health & Safety Alternate: Sean Quinn/Mallory Neldner

**Response Activities/Dates of Response (fill in as applicable)**

**Emergency Response:**

- ☐ Perimeter Recon
- ☐ Site Entry
- ☐ Visual Documentation

- ☐ Multi-Media Sampling
- ☐ Decontamination

**Removal Assessment:**

- ☐ Site Radiation Screening:
- ☐ Site Entry
- ☐ Visual Documentation
- ☐ Multi-Media Sampling
- ☐ Decontamination:

**Removal Action:**

- ☒ Perimeter Recon: Beginning October 14, 2019
- ☒ Site Entry: Beginning October 14, 2019
- ☒ Visual Documentation: Beginning October 14, 2019
- ☒ Multi-Media Sampling: Beginning October 14, 2019
- ☒ Decontamination: Beginning October 14, 2019

**Physical Safety Hazards to Personnel:**

<input checked="" type="checkbox"/>	Inclement Weather – Attach FLD02	<input checked="" type="checkbox"/>	Heat – Attach FLD05	<input checked="" type="checkbox"/>	Cold – Attach FLD06
<input type="checkbox"/>	Confined Space – Attach FLD08	<input checked="" type="checkbox"/>	Industrial Trucks – Attach FLD09	<input type="checkbox"/>	Manual Lifting – Attach FLD10
<input checked="" type="checkbox"/>	Terrain – Attach FLD11	<input type="checkbox"/>	Structural Integrity – Attach FLD13	<input type="checkbox"/>	Site Security – Attach FLD14
<input type="checkbox"/>	Pressurized Containers, Systems – Attach FLD16	<input type="checkbox"/>	Use of Boats – Attach FLD18	<input type="checkbox"/>	Waterways – Attach FLD19
<input type="checkbox"/>	Explosives – Attach FLD21	<input checked="" type="checkbox"/>	Heavy Equipment – Attach FLD22	<input type="checkbox"/>	Aerial Lifts and Manlifts – Attach FLD24
<input type="checkbox"/>	Elevated Surfaces and Fall Protection – Attach FLD25	<input type="checkbox"/>	Ladders – Attach FLD26	<input checked="" type="checkbox"/>	Excavations/Trenching – Attach FLD28
<input type="checkbox"/>	Fire Prevention – Attach FLD31	<input type="checkbox"/>	Demolition – Attach FLD33	<input checked="" type="checkbox"/>	Underground/Overhead Utilities – Attach FLD34
<input checked="" type="checkbox"/>	Hand and Power Tools – Attach FLD38	<input type="checkbox"/>	Illumination – Attach FLD39	<input type="checkbox"/>	Storage Tanks – Attach FLD40
<input type="checkbox"/>	Lead Exposure – Attach FLD46	<input checked="" type="checkbox"/>	Sample Storage – Attach FLD49	<input type="checkbox"/>	Cadmium Exposure – Attach FLD50
<input type="checkbox"/>	Asbestos Exposure – Attach FLD52	<input type="checkbox"/>	Hexavalent Chromium Exposure – Attach FLD 53	<input type="checkbox"/>	Benzene Exposure – Attach FLD 54
<input checked="" type="checkbox"/>	Drilling Safety – Attach FLD56	<input type="checkbox"/>	Drum Handling – Attach FLD58	<input type="checkbox"/>	Gasoline Contaminant Exposure – Attach FLD61
<input checked="" type="checkbox"/>	Noise – Attach FLD 01	<input checked="" type="checkbox"/>	Walking/Working Surfaces	<input checked="" type="checkbox"/>	Motor Vehicle Safety – Attach FLD57
<input type="checkbox"/>	Unknowns in Tanks or Drums	<input type="checkbox"/>	Nonionizing Radiation	<input checked="" type="checkbox"/>	Ionizing Radiation – Attach Radiation Safety Operating Practice

### **Biological Hazards to Personnel:**

- |   |  |
|---|--|
| <input type="checkbox"/> Infectious/Medical/Hospital Waste – Attach FLD 44 and 45 | <input checked="" type="checkbox"/> Non-domesticated Animals – Attach START V FLD43A     |
| <input checked="" type="checkbox"/> Insects – Attach START V FLD 43B              | <input checked="" type="checkbox"/> Poisonous Plants/Vegetation – Attach START V FLD 43D |
| <input type="checkbox"/> Raw Sewage   | <input type="checkbox"/> Bloodborne Pathogens – Attach FLD 44 and 45                     |

### **Training Requirements:**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> 40-Hour HAZWOPER Training with three days supervised experience | <input type="checkbox"/> 8-Hour Management or Supervisor Training in addition to basic training course |
| <input checked="" type="checkbox"/> 8-Hour Annual Refresher Health and Safety Training              | <input checked="" type="checkbox"/> Site Specific Health and Safety Training                           |
| <input type="checkbox"/> DOT (CMV Training - ERV in Use)  | <input type="checkbox"/> Bio-Medical Collection and Response   |

### **Medical Surveillance Requirements:**

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Baseline initial physical examination with physician certification  | <input checked="" type="checkbox"/> Annual medical examination with physician certification |
| <input checked="" type="checkbox"/> Site-specific medical monitoring protocol (Radiation, Heavy Metals) | <input type="checkbox"/> Asbestos worker medical protocol                                   |

### **Vehicle Use Assessment and Selection:**

Driving is one of the most hazardous and frequent activities for Weston Employees. As such, Weston Employees are required to adhere to established safe operating practices in order to maintain their eligibility to drive Weston owned, leased, or rented vehicles. Every person riding in a Weston vehicle, including passengers must maintain a commitment for a safe journey. This means being attentive while in the vehicle and helping the driver to notice hazards ahead of and around the vehicle and ensure that their presence does not distract the driver from safely operating the vehicle.

A high percentage of vehicle accidents occur when operating in reverse. Anytime a vehicle is operated in reverse, e.g., backing out of a parking area, if there are passengers, at least one of them are to assist the driver by acting as a guide person during the reverse movement or during other vehicle operation where it would be prudent to have a guide person(s) participate in the vehicle movement. When practical, the preferred parking method would be to back into the parking area.

1. The following vehicles are anticipated to be used on this project:

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Car   | <input type="checkbox"/> Pickup Truck   |
| <input checked="" type="checkbox"/> Intermediate/Standard SUV (e.g. Chevy Trailblazer, Chevy Tahoe, Ford Explorer, Ford Escape) | <input checked="" type="checkbox"/> Full Size SUV (e.g. Chevy Suburban, Ford Expedition, GMC Yukon) |
| <input type="checkbox"/> Minivan/Cargo Van (e.g. Chevy Uplander, Chevy Express Van)   | <input type="checkbox"/> Box Truck (Size: approx. 12 feet)  |
| <input type="checkbox"/> Emergency Response Vehicle (ERV)   | <input type="checkbox"/> Other _____  |

2. Are there any on-site considerations that should be noted:

- |  |  |  |   |
|--|--|--|---|
| <input checked="" type="checkbox"/> Working/Driving Surfaces | <input checked="" type="checkbox"/> Debris       | <input type="checkbox"/> Overhead Clearance              | <input type="checkbox"/> Obstructions       |
| <input checked="" type="checkbox"/> Tire Puncture Hazards    | <input checked="" type="checkbox"/> Vegetation   | <input checked="" type="checkbox"/> Terrain              | <input checked="" type="checkbox"/> Parking |
| <input type="checkbox"/> Congestion                          | <input type="checkbox"/> Site Entry/Exit Hazards | <input checked="" type="checkbox"/> Local Traffic Volume | <input type="checkbox"/> Security           |
| <input checked="" type="checkbox"/> Heavy Equipment          | <input type="checkbox"/> Time/Length of Work Day | <input type="checkbox"/> Other:                          |   |

Do any of the considerations above require further explanation: No.

3. Was the WESTON Environmental Risk Management Tool completed in EHS? Yes.

Was an Environmental Compliance Plan required? No.

4. Are there any seasonal considerations that should be noted (e.g., Anticipated Snowy Conditions): Snowy conditions could occur late in the project as winter approaches.

5. Is a Traffic Control Plan required? ☐ Yes ☒ No

Physical Parameters	<u>Radium</u> (See Attachments)	<u>Thorium</u> (See Attachments)	<u>Radon</u> (See Attachments)
Exposure Limits / IDLH Level	_____ ppm _____ mg/m <sup>3</sup> PEL _____ ppm _____ mg/m <sup>3</sup> REL _____ ppm _____ mg/m <sup>3</sup> IDLH	_____ ppm _____ mg/m <sup>3</sup> PEL _____ ppm _____ mg/m <sup>3</sup> REL _____ ppm _____ mg/m <sup>3</sup> IDLH	_____ ppm _____ mg/m <sup>3</sup> PEL _____ ppm _____ mg/m <sup>3</sup> REL _____ ppm _____ mg/m <sup>3</sup> IDLH
Physical Form (Solid/Liquid/Gas) Color	_____ Solid _____ Liquid _____ Gas Variable _____ Color	_____ Solid _____ Liquid _____ Gas Variable _____ Color	_____ Solid _____ Liquid _____ Gas Variable _____ Color
Odor			
Flash Point Flammable Limits	_____ Degrees F or C _____ % UEL _____ % LEL	_____ Degrees F or C _____ % UEL _____ % LEL	_____ Degrees F or C _____ % UEL _____ % LEL
Specific Gravity	_____ Water = 1	_____ Water = 1	_____ Water = 1
Solubility			
Incompatible Mterials			
Routes of Exposure	_____ Inh _____ Abs _____ Con _____ Ing	_____ Inh _____ Abs _____ Con _____ Ing	_____ Inh _____ Abs _____ Con _____ Ing
Symptoms of Acute Exposure			
First Aid Treatment			
Ionization Potential	_____ eV	_____ eV	_____ eV
Instruments for Detection	_____ PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube _____ Other _____ Lumex	_____ PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube _____ Other _____ Lumex	_____ PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube _____ Other _____ Lumex

**Control Measures:** Work zones are currently unknown. The appropriate work zones will be determined on-site during Site orientation.



*This map is subject to Google's Terms of Service, and Google is the owner of rights therein.  
Portions of this image have been removed for clarity.*

### **Work Zone Definitions:**

**Exclusion Zone** - the area where contamination is either known or expected to occur and the greatest potential for exposure exists. The outer boundary of the Exclusion Zone, called the Hotline, separates the area of contamination from the rest of the Site.

**Contamination Reduction Zone (CRZ)** - the area in which decontamination procedures take place. The purpose of the CRZ is to reduce the possibility that the Support Zone will become contaminated or affected by the site hazards.

**Support Zone** - the uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions. The Support Zone is the appropriate location for the command post, medical station, equipment and supply center, field laboratory, and any other administrative or support functions that are necessary to keep site operations running efficiently.

### Communications:

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Buddy System  | <input type="checkbox"/> Radio                                  |
| <input type="checkbox"/> Air Horn for Emergencies | <input checked="" type="checkbox"/> Hand Signals/Visual Contact |

### Personnel Decontamination Procedures:

- ☐ Wet Decontamination (procedures as follows)
- ☒ Dry Decontamination (procedures as follows)

Soil sampling in test pits will be conducted in modified Level D PPE, i.e. hard hat and Tyvek coveralls. All used PPE will be grossly decontaminated and disposed of in accordance with applicable federal, state, and local regulations.

### Equipment Decontamination Procedures:

- ☒ None
- ☐ Wet Decontamination (procedures as follows)
- ☐ Dry Decontamination (procedures as follows)

No equipment decontamination is anticipated during this phase of the Removal Action, since disposable equipment will be used; however, The EPA ERRS contractor is required to remove excess soil from the excavation equipment prior to leaving the Site. The excess soil will be removed from the site and disposed of properly.

Adequacy of decontamination determined by: START V Health and Safety Officer

### Personal Protective Equipment

TASK TO BE PERFORMED	ANTICIPATED LEVEL OF PROTECTION	TYPE OF CHEMICAL PROTECTIVE COVERALL	INNER GLOVE / OUTER GLOVE / BOOT COVER	APR CARTRIDGE TYPE or SCBA
Site Documentation	Level D	None	Nitrile/Nitrile/None	None
Excavation Pit Sampling	Level D* (modified)	None	Nitrile/Nitrile/Latex boot covers	None
Removal Action Oversight	Level D	None	Nitrile/Nitrile/None	None
Air Monitoring and Sampling	Level D	None	Nitrile/Nitrile/None	None
HPGe Soil Sample Analysis	Level D	None	Nitrile/Nitrile/None	None

\*Modified Level D: includes hard hat and Tyvek coveralls

## Hazard Task Analysis:

RISK LEVEL (High, Medium, Low)	TASK/HAZARD	RECOGNITION/ SYMPTOMS	MITIGATION	LEVEL OF PROTECTION
High	<u>Task:</u> Documentation and Sampling <u>Hazard:</u> Exposure to low-level alpha and gamma radiation	Realtime radiation monitoring equipment and comparison to site specific action levels.	PPE for contamination control and limit time in hot zone.	Level D/Level D* (Modified)
Medium	<u>Task:</u> Documentation and Sampling <u>Hazard:</u> Slips, Trips, Falls and Uneven Walking Surfaces	Exterior walking surfaces clear of debris, fallen trees, overgrown vegetation and uneven surfaces that may increase the potential for an incident.	Maintain walking paths in cleared areas.	Level D/Level D* (Modified)
Low/Medium	<u>Task:</u> Documentation and Sampling <u>Hazard:</u> Animals (low), Insects & Hazardous Plants (Medium).	Activities conducted outdoors have the potential for contact with poisonous plants, insects, and snakes in addition to potential contact with other animals.	The SSHO shall review biological hazards native to the site location and Field Operating Procedures (FLD) 43 (et seq.) with all employees and identify those employees with allergies. Use of tyvek coveralls.	Level D/Level D* (Modified)
High	<u>Task:</u> Documentation and Sampling <u>Hazard:</u> Working Around Heavy Equipment	Activities conducted near heavy equipment have the potential for injury.	Use of hard hats and steel toe boots, awareness of surroundings, maintaining eye contact with equipment operator.	Level D* (Modified)
Medium	<u>Task:</u> Documentation and Sampling <u>Hazard:</u> Exposure to noise.	Activities conducted near heavy equipment have the potential for noise impairment.	Use of ear plugs, ear muffs, and other noise cancelling PPE.	Level D
Low	<u>Task:</u> Driving <u>Hazards:</u> Vehicular loss of control i.e. swerving or skidding into traffic or pedestrians. Collision with stationary objects.	Distractions while driving. Poor driving conditions, i.e. rain. Exhaustion/lack of sleep.	-Maintain eyes on road while moving; check rear view mirrors and side mirrors when backing up and changing lanes. -Wear seat belt and make sure there is a line of sight in all directions. -Reduce speed when road condition is slippery. -Pull to curb to answer phone calls. -Switch driver if exhausted or stop to take short naps before continuing. -Maintain eyes on road while moving; check rear view mirrors and side mirrors when backing up and changing lanes.	Seat Belt and Driver Airbags

\*Modified Level D: includes hard hat and Tyvek coveralls

### Frequency and Types of Air Monitoring:

☒ Continuous
 ☐ Routine - \_\_\_\_\_
 ☐ Periodic - \_\_\_\_\_

<b>DIRECT READING INSTRUMENTS</b>	<b>LUDLUM MODEL 2241 SURVEY METER</b>	<b>LUDLUM MODEL 19 SURVEY METER</b>	<b>LUDLUM MODEL 2211 SURVEY METER</b>	<b>DataRAM 4 Particulate Monitor</b>
EQUIPMENT ID NUMBER	TBD	TBD	TBD	TBD
CALIBRATION DATE	TBD	TBD	TBD	TBD
START V /START III PERSONNEL	Mallory Neldner/ Sean Quinn	Mallory Neldner/ Sean Quinn	Mallory Neldner/ Sean Quinn	Mallory Neldner/ Sean Quinn
ACTION LEVEL	≥ 1,000 uR/Hr– Exit Area, Establish Perimeter, Contact START V HSO	≥ 1,000 uR/Hr– Exit Area, Establish Perimeter, Contact START V HSO	≥ 1,000 uR/Hr– Exit Area, Establish Perimeter, Contact START V HSO	NA

### Emergency Telephone Numbers:

Emergency Contact	Location / Address	Telephone Number	Notified
<b>Hospital</b>	Mount St. Mary's Hospital and Health Center 5300 Military Road Lewiston, NY 14092	Call 911 or 716-297-4800	Yes
<b>Ambulance</b>	Twin City Ambulance 365 Fillmore Avenue Tonawanda, NY 14150	911	No
<b>Police</b>	Niagara Police Department 7105 Lockport Road Niagara Falls, NY 14305	Call 911 or 716-297-2150	No
<b>Fire Department</b>	Bergholz Fire Company 2470 Niagara Road Niagara Falls, NY 14304	Call 911 or 716-731-4848	No

Chemical Trauma Capability?

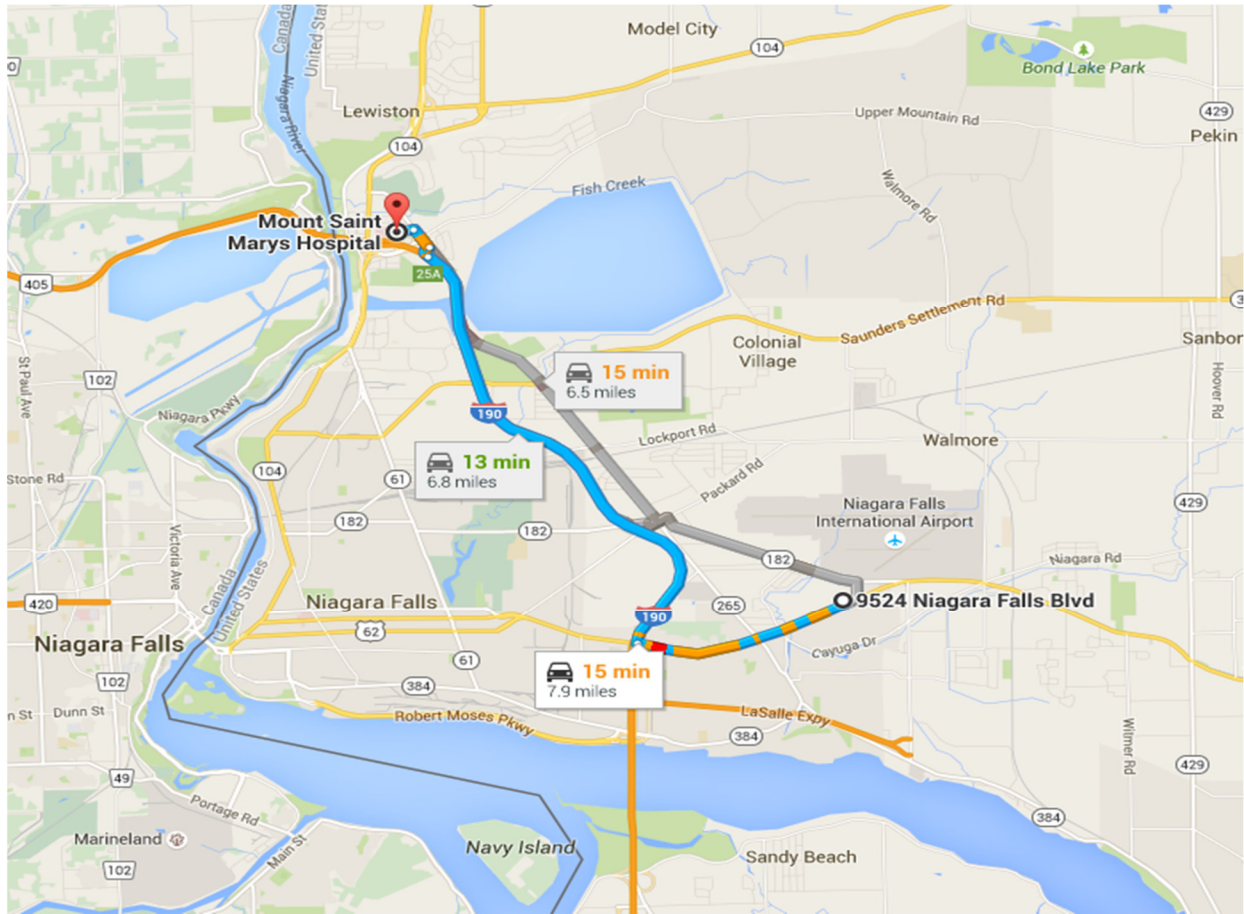
☒ Yes    ☐ No

If no, closest backup: \_\_\_\_\_ Phone:

### Directions to Hospital:

1. Head **southwest** on **US-62 N/Niagara Falls Blvd** toward **Niemel Dr.** 2.0 mi
2. Turn **right** to merge onto **I-190 N** 5.3 mi
3. Take exit **25A** for **NY-265** toward **Lewiston** 0.1 mi
4. Turn **left** onto **NY-265 N**; destination will be on the **left** 0.3 mi

**Total Distance: 6.8 mi les; Total Time: 13 minutes. See map on following page.**



*This map is subject to Google's Terms of Service, and Google is the owner of rights therein. Portions of this image have been removed for clarity.*

Route verified by: SG

Date: 10/10/2019

**Additional Emergency Telephone Contacts:**

<b>WESTON Medical Emergency Service</b> Dr. Peter Greaney, Medical Director WorkCare 300 South Harbor Blvd, Suite 600 Anaheim, California 92805	800-455-6155 Regular Business Hours (9AM to 7:30PM) <b>Dial 0 or Ext. 175 for Michelle Bui to request the on-call clinician.</b> 800-455-6155 After Hours (Weekdays 7:31PM to 8:59AM, Weekends, Holidays) <b>Dial 3 to reach the after-hours answering service. Request that the service connect you with the on-call clinician or the on-call clinician will return your call within 30 minutes.</b>
Chemtrec	800-424-9300
ATSDR	404-639-0615
ATF (explosives information)	800-424-9555
National Response Center	800-424-8802
National Poison Control Center	800-764-7661
<b>Chemtel</b>	800-255-3924
DOT	800-424-8802
CDC	800-232-0124

**Pre-Response Approval:**HASP prepared by: Sean QuinnDate: 10/10/2019Pre-Response/Entry Approval by: Date: 10/10/2019

<b>Tasks Conducted</b>	<b>Level of Protection/Specific PPE Used</b>
Site Documentation Activities	Level D/Steel Toe Boots, Safety Glasses, Nitrile Gloves
Excavation Pit Sampling	Level D (modified)/Steel Toe Boots, Safety Glasses, Nitrile Gloves, Hard Hat, Tyvek
Removal Action Oversight	Level D/Steel Toe Boots, Safety Glasses
Air Monitoring and Sampling	Level D/Steel Toe Boots, Safety Glasses
HPGe Soil Sample Analysis	Level D/Steel Toe Boots, Safety Glasses, Nitrile Gloves

## **Hazardous Waste Site and Environmental Sampling Activities**

Off Site: ☐ Yes ☒ No

On Site: ☒ Yes ☐ No

Describe types of samples and methods used to obtain samples:

### **Air Sampling:**

Air sampling will be conducted daily at each monitoring station with RADēCO air samplers calibrated by the manufacturer and equipped with replaceable filter media. The filter media will be used to collect ambient air samples at a flow rate determined by the EPA Health Physicist in cubic feet per minute (CFM). Prior to and at the end of each air sampling event, a portable calibrator will be utilized to recalibrate each RADēCO unit to the desired flow rate in order to determine the average flow rate for the selected sampling period. Each RADēCO will be mounted on a tripod stand, powered with an electric generator, and positioned in an opposing wind direction. Air samples will be collected from perimeter air monitoring locations upon initiation of intrusive activities (excavation) and periodically as needed depending on changes in Site conditions, expected elevated contaminant concentrations in soils being excavated, and if analytical results of previous air samples indicate there is a need for further sampling. The samples will be analyzed on-site by EPA's Health Physicist using a Ludlum (Model 3030) Alpha Beta counter.

### **Excavation Pit Soil Sampling:**

Soil sampling will be conducted in accordance with EPA's Environmental Response Team (ERT)/Scientific, Engineering, Response and Analytical Services (SERAS) contractor's Standard Operating Procedure (SOP) Number (No.) 2001: *General Field Sampling Guidelines* and SOP No. 2012: *Soil Sampling*. Soil sampling locations will be preselected by the EPA OSC based on results of a radiological survey performed at each excavation pit by START V. After subsurface utility clearance is completed on-site, earth-moving equipment will be utilized by ERRS to advance excavations to depths of up to 4 feet bgs throughout the Site. Composite soil samples will be collected from the bottom of the excavation pit floor and side walls at depths up to 48 inches bgs. The soil samples will be collected using dedicated disposable scoops, and fresh nitrile gloves will be donned between each sampling location. Prior to sample collection at each location, the bottom of the scoop will be used to scrape each area of the sidewall and floor, in order to expose fresh soil which will then be collected, placed directly into re-sealable plastic bags, homogenized in the plastic bags, and then placed into polyurethane sample containers. The samples will then be analyzed on-site for gamma radiation emitting isotopes with the HPGe Radiation Detector in order to confirm that the contaminated soil has been removed from the pit prior to backfilling the excavation.

Disclaimer: This HASP was prepared for work to be conducted under START V Contract 68HE0319D0004. Use of this HASP by WESTON and its subcontractors is intended to fulfill the OSHA requirements found in 29 CFR 1910.120. Items not specifically covered in this HASP are included by reference to 29 CFR 1910 and 1926.

The signatures below indicate that the individuals have read and understood this Health and Safety Plan.

PRINTED NAME	SIGNATURE	AFFILIATION	DATE

**Post-Response Approval**

Final Submission of HASP by:		Date:
Post Response Approval by:		Date:
START V HSO Review by:		Date:

### Air Monitoring Summary Log:

Date: \_\_/\_\_/\_\_

Data Collected by: \_\_\_\_\_

Station/Location	CGI / O <sub>2</sub> Meter / CL <sub>2</sub> / H <sub>2</sub> S	Radiation Meter	PID	FID / TVA-1000	Other ( <u>PDR</u> )

## **ATTACHMENT A**

### **RADIUM, RADON, AND THORIUM FACT SHEETS**


<http://www.epa.gov/radiation/radionuclides/radium.html>

Last updated on 3/6/2012

## Radiation Protection

You are here: [EPA Home](#) [Radiation Protection](#) [References](#) [Reference Information](#)  
[Radionuclides](#) Radium

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[PROGRAMS](#) [TOPICS](#) [REFERENCES](#)

# Radium

Radium (chemical symbol Ra) is a naturally-occurring radioactive metal. Its most common isotopes are radium-226, radium 224, and radium-228. Radium is a radionuclide formed by the decay of uranium and thorium in the environment. It occurs at low levels in virtually all rock, soil, water, plants, and animals.

### On this page:

#### The Basics

- [Who discovered radium?](#)
- [Where does radium come from?](#)
- [What are the properties of radium?](#)
- [What is radium used for?](#)

#### Exposure to Radium

- [How does radium get into the environment?](#)
- [How does radium change in the environment?](#)
- [How do people come in contact with radium?](#)
- [How does radium get into the body?](#)
- [What does radium do once it gets into the body?](#)

#### Health Effects of Radium

- [How can radium affect people's health?](#)
- [Is there a medical test to determine exposure to radium?](#)

#### Protecting People from Radium

- [How do I know if I'm near radium?](#)
- [What can I do to protect myself and my family from radium?](#)
- [What is EPA doing about radium?](#)

### Reference Information

- People and Discoveries
- Commonly Encountered Radionuclides
  - Americium-241
  - Cesium-137
  - Cobalt-60
  - Iodine-129 & -131
  - Plutonium
  - Radium
  - Radon
  - Strontium-90
  - Technetium-99
  - Tritium
  - Thorium
  - Uranium
- Glossary
- Acronyms
- A-Z Subject Index
- Site Map

## The Basics

### Who discovered radium?

Radium was discovered in 1898 by French physicist and Nobel laureate Marie Curie in pitchblende (a uranium and radium-bearing mineral). There is about 1 gram of radium in 7 tons of pitchblende. Elemental radium was isolated by Mme. Curie in 1911.

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### **Where does radium come from?**

Radium forms when isotopes of uranium or thorium decay in the environment. Most radium (radium-226) originates from the decay of the plentiful uranium-238.

In the natural environment, radium occurs at very low levels in virtually all rock, soil, water, plants, and animals. When uranium (or thorium) occurs in high levels in rock, radium is often also found in high levels.

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### **What are the properties of radium?**

Radium is a naturally radioactive, silvery-white metal when freshly cut. It blackens on exposure to air.

Purified radium and some radium compounds glow in the dark (luminesce). The radiation emitted by radium can also cause certain materials, called "phosphors" to emit light. Mixtures of radium salts and appropriate phosphors were widely used for clock dials and gauges before the risks of radium exposure were understood.

Metallic radium is highly chemically reactive. It forms compounds that are very similar to barium compounds, making separation of the two elements difficult.

The various isotopes of radium originate from the radioactive decay of uranium or thorium. Radium-226 is found in the uranium-238 decay series, and radium-228 and -224 are found in the thorium-232 decay series.

Radium-226, the most common isotope, is an alpha emitter, with accompanying gamma radiation, and has a half-life of about 1600 years. Radium-228, is principally a beta emitter and has a half-life of 5.76 years. Radium-224, an alpha emitter, has a half life of 3.66 days. Radium decays to form isotopes of the radioactive gas radon, which is not chemically reactive. Stable lead is the final product of this lengthy radioactive decay series.

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### **What is radium used for?**

In the early 1900's, when it was newly discovered, no one understood the dangers of radium. People were fascinated with its mysterious properties, especially the luminescence produced when it is mixed with a phosphor. Industries sprang up to manufacture hundreds of consumer products containing radium. Advertisements proclaimed its special powers and unique effects in such products such as hair tonic, toothpaste, ointments, and elixirs. Glow in the dark watch and clock faces were immensely popular.

Most of its original uses have been halted for health and safety reasons, but its wide use in luminescent paints continued through World War II, because the soft glow of radium's luminescence made aircraft dials, gauges and other instruments visible to their operators at night. Radium was also an early radiation source for cancer treatment. Small seeds were

implanted in tumors to kill cancerous cells. Safer, more effective radiation sources, such as cobalt-60 have mostly replaced it.

Radium is a radiation source in some industrial radiography devices, a technology similar to x-ray imaging used in industry to inspect for flaws in metal parts. When radium is mixed with beryllium it becomes a good source of neutrons, useful in well logging devices and research. Radium also has been added to the tips of lightening rods, improving their effectiveness by ionizing the air around it.

---

## **Exposure to Radium**

### **How does radium get into the environment?**

Radium occurs naturally in the environment. As a decay product of uranium and thorium, it is common in virtually all rock, soil, and water. Usually concentrations are very low. However, geologic processes can form concentrations of naturally radioactive elements, especially uranium and radium. Radium and its salts are soluble in water. As a result, groundwater in areas where concentrations of radium are high in surrounding bedrock typically has relatively high radium content.

---

### **How does radium change in the environment?**

All isotopes of radium are radioactive. As they decay, they emit radiation and form new radioactive elements, until they reach stable lead. Isotopes of radium decay to form different isotopes of radon. For example, radium-226 decays to radon-222, and radium-228 goes through several decays to radium-224 before forming radon-220.

---

### **How do people come in contact with radium?**

Since radium is present at low levels in the natural environment, everyone has some minor exposure to it. However, individuals may be exposed to higher levels of radium if they live in an area where there is an elevated level of radium in the surrounding rock and soil. Private well water in such areas can also be an added source of radium.

The concentration of radium in drinking water is generally low, but there are specific geographic regions in the United States where higher concentrations of radium occur in water due to geologic sources. Limited information is available about the amounts of radium that are typically present in food and air, but they are very low.

People can also be exposed to radium if it is released into the air from the burning of coal or other fuels. Certain occupations can also lead to high exposures to radium, such as working in a uranium mine or in a plant that processes ores. Phosphate rocks typically contain relatively high levels of both uranium and radium and can be a potential source of exposure in areas where phosphate is mined.

In some parts of the country, former radium processing plants exist that were highly contaminated with radium. However, most of these have been cleaned up and do not pose a serious health threat any longer.

Radium emits several different kinds of radiation, in particular, [alpha](#) and [gamma](#) radiation. Alpha radiation is only a concern if radium is taken into the body through inhalation or ingestion. Gamma radiation, or rays, can expose individual even at a distance. As a result, radium on the ground, for example, can expose individuals externally to gamma rays or be inhaled or ingested with contaminated food or water. The greatest health risk from radium in the environment, however, is actually its decay product radon, which can collect in buildings.

---

### **How does radium get into the body?**

People may swallow radium with food and water, or may inhale it as part of dust in the air. Radium can also be produced in the body from "parent" radionuclides (uranium and thorium) that have been inhaled or swallowed, but this is not a significant source.

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### **What does radium do once it gets into the body?**

Most radium that is swallowed (about 80%) promptly leaves the body through the feces. The other 20% enters the bloodstream and accumulates preferentially in the bones. Some of this radium is excreted through the feces and urine over a long time. However, a portion will remain in the bones throughout the person's lifetime.

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## **Health Effects of Radium**

### **How can radium affect people's health?**

Radium emits several different kinds of radiation, in particular, alpha particles and gamma rays. Alpha particles are generally only harmful if emitted inside the body. However, both internal and external exposure to gamma radiation is harmful. Gamma rays can penetrate the body, so gamma emitters like radium can result in exposures even when the source is a distance away.

Long-term exposure to radium increases the risk of developing several diseases. Inhaled or ingested radium increases the risk of developing such diseases as lymphoma, bone cancer, and diseases that affect the formation of blood, such as leukemia and aplastic anemia. These effects usually take years to develop. External exposure to radium's gamma radiation increases the risk of cancer to varying degrees in all tissues and organs.

However, the greatest health risk from radium is from exposure to its radioactive decay product radon. It is common in many soils and can collect in homes and other buildings.

- [Radon](#)  
This fact sheet describes the basic properties and uses, and the hazards associated with this radionuclide. It also discusses radiation protection related to it.
  - [Radon Home Page](#)  
This site provides information about the hazards and management of radon.
-

## **Is there a medical test to determine exposure to radium?**

There are tests that can determine exposure to radium or other radioactive substances. For example, a whole body count can measure the total amount of radioactivity in the body, and urine and feces can be tested for the presence of radionuclides.

These tests are not routinely performed in a doctor's office because it requires special laboratory equipment. There is no test that can detect external exposure to radium's gamma radiation, unless the doses were very high, and cellular damage is detectable.

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## **Protecting People from Radium**

### **How do I know radium if I'm near radium?**

You need special equipment to detect the presence of radium. However, you can buy radon detection kits at most hardware stores.

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### **What can I do to protect myself and my family from radium?**

The most effective way to protect yourself and your family is to test your home for radium's decay product, radon.

- [Radon Home Page](#)  
This site provides information about the hazards and management of radon.
- 

### **What is EPA doing about radium?**

The U.S. Congress passes laws that authorize EPA and other federal agencies, to protect public health and the environment from radium and other radioactive materials. EPA has issued a variety of regulations that limit the release of radium and other radionuclides to the environment. For example, Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA). EPA has established standards for cleaning up and managing leftover uranium ore at inactive ore-processing plants under the authority of UMTRCA. The U.S. Department of Energy is responsible for conducting the cleanups, and the U.S. Nuclear Regulatory Commission oversees and manages them.

- [UMTRCA](#)  
This page provides a summary and link to the full statute.

Complementing these efforts, EPA's Superfund program identifies abandoned industrial sites contaminated with radium and other radionuclides and chemicals. It then assesses the health and environmental risks the sites pose, and assigns priorities for cleaning them up based on those risks. Superfund regulations require sites to be cleaned up to the point that people living on the sites after cleanup would have no more than a 1-in-10,000 to a 1-in-1,000,000 increased risk of developing cancer from exposure to contaminants.

- [CERCLA](#)  
This page provides a summary and a link to the complete statute.
- [Superfund](#)  
This site contains information about individual Superfund sites.

Other laws passed by Congress address specific environmental media. The Clean Air Act authorizes EPA to establish annual limits, known as National Emission Standards for Hazardous Air Pollutants, for the maximum amount of radium and other radionuclides that may be released to the air. For radium the "NESHAP" is 10 millirem. The Safe Drinking Water Act authorizes EPA to limit the Maximum Contaminant Levels of radium and other radionuclides in publicly supplied drinking water. For 226 and 228 radium, the MCL is 5 picocuries per liter and for 224 radium it is 15pCi/l. Both the air and water standards limit the increased lifetime cancer risk to about 2 in 10,000.

- [Clean Air Act](#)  
This page provides a summary and a link to the complete act.
- [Safe Drinking Water Act](#)  
This page provides a summary and a link to the complete act.

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[Understanding Radiation in Your Life, Your World](#)

[Programs](#) · [Topics](#) · [References](#)



## Radiation Protection

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# Radon

Radon (chemical symbol Rn) is a naturally occurring radioactive gas found in soils, rock, and water throughout the U.S. It has numerous different isotopes, but radon-220, and -222 are the most common. Radon causes lung cancer, and is a threat to health because it tends to collect in homes, sometimes to very high concentrations. As a result, radon is the largest source of exposure to naturally occurring radiation.

### On this page:

#### The Basics

- [Who discovered radon?](#)
- [Where does radon come from?](#)
- [What are the properties of radon?](#)
- [Does radon have any practical uses ?](#)

#### Exposure to Radon

- [How does radon get into the environment?](#)
- [How does radon change in the environment?](#)
- [How are people exposed to radon?](#)
- [How does radon get into the body?](#)
- [What does radon do once it gets into the body?](#)

#### Health Effects of Radon

- [How can radon affect people's health?](#)
- [Is there a medical test to determine exposure to radon?](#)

#### Protecting People From Radon

- [How do I know if there is radon in my home?](#)
- [What can I do to protect myself and my family from radon?](#)
- [What recommendations has the federal government made to protect human health from radon?](#)
- [What is EPA doing about radon?](#)

### Reference Information

- [People and Discoveries](#)
- [Commonly Encountered Radionuclides](#)
  - [Americium-241](#)
  - [Cesium-137](#)
  - [Cobalt-60](#)
  - [Iodine-129 &-131](#)
  - [Plutonium](#)
  - [Radium](#)
  - [Radon](#)
  - [Strontium-90](#)
  - [Technetium-99](#)
  - [Tritium](#)
  - [Thorium](#)
  - [Uranium](#)
- [Glossary](#)
- [Acronyms](#)
- [A-Z Subject Index](#)
- [Site Map](#)

## The Basics

## Who Discovered Radon

The German chemist Friedrich E. Dorn discovered radon-222 in 1900, and called it radium emanation. However, a scarcer isotope, radon-220, was actually observed first, in 1899, by the British scientist, R.B. Owens, and the New Zealand scientist, Ernest Rutherford. The medical community nationwide became aware of the possible extent of a radon problem in 1984. That year a nuclear plant worker in Pennsylvania discovered radioactivity on his clothing while exiting his place of work through the radiation detectors. The source of the radiation was determined to be radon decay products on his clothing originating from his home.

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## Where does radon come from?

Radon-222 is the decay product of radium-226. Radon-222 and its parent, radium-226, are part of the long decay chain for uranium-238. Since uranium is essentially ubiquitous in the earth's crust, radium-226 and radon-222 are present in almost all rock and all soil and water.

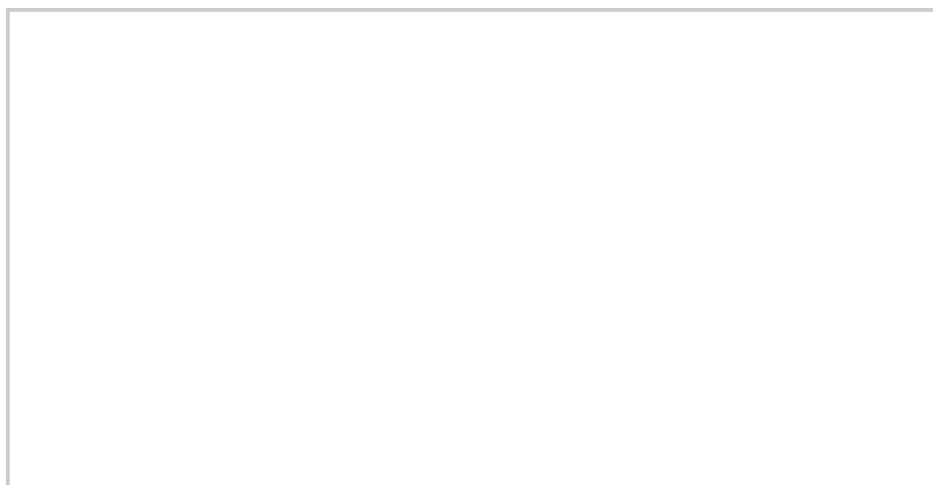
## More Info

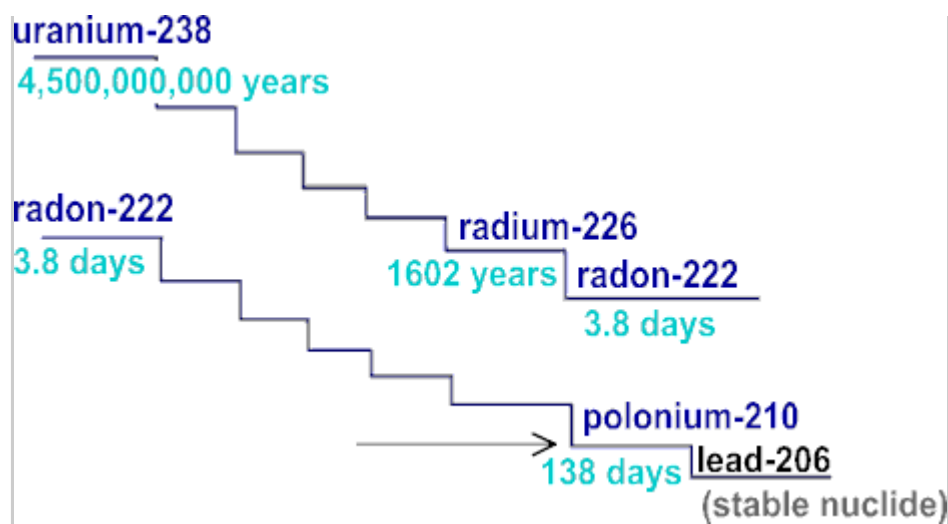
- [Decay Chains - Uranium Decay](#)  
This link provides an illustration of uranium-238 decays through a series of steps to become a stable form of lead.
  - [Uranium](#)  
This fact sheet describes the basic properties and uses, and the hazards associated with this radionuclide. It also discusses radiation protection related to it.
- 

## What are the properties of radon?

Radon is a noble gas, which means it is basically *inert* (does not combine with other chemicals). Radon is a heavy gas and tends to collect in basements or other low places in housing. It has no color, odor, or taste. Radon-222 is produced by the decay of radium, has a half-life of 3.8 days, and emits an alpha particle as it decays to polonium-218, and eventually to stable lead. Radon-220, is the decay product of thorium – it is sometimes called thoron, has a half-life of 54.5 seconds and emits an alpha particle in its decay to polonium-216.

The illustration below provides an overview of the uranium-238 decay chain. Radon is part of that decay chain and is produced by the radioactive decay of radium.





### More Info

- [Radioactive Decay](#)  
This page explains radioactive decay chains.

### Does radon have any practical uses?

Radon has little practical use. Some medical treatments have employed radon in small sealed glass tubes, called seeds, that are specially manufactured to contain the exact amount of radioactivity needed for the application. Radon spas are used extensively in Russia and Central Europe to treat a number of conditions.

## Exposure to Radon

### How does radon get into the environment?

Radon-222 is the radioactive decay product of radium-226, which is found at low concentrations in almost all rock and soil. Radon is generated in rock and soil, and it creeps through cracks or spaces between particles up to the outside air. Although outdoor concentrations of radon are typically low, about 0.4 picocuries per liter (pCi/l) of air, it can seep into buildings through foundation cracks or openings and build up to much higher concentrations indoors, if the sources are large enough.

The average indoor radon concentration is about 1.3 pCi/l of air. It is not uncommon, though, for indoor radon levels to be found in the range of 5 - 50 pCi/l, and they have been found as high as 2,000 pCi/l. The concentration of radon measured in a house depends on many factors, including the design of the house, local geology and soil conditions, and the weather. Radon's decay products are all metallic solids, and when radon decay occurs in air, the decay products can cling to aerosols and dust, which makes them available for inhalation into the lungs.

Radon easily dissolves in water in areas of the country that have high radium content in soils and rocks, local ground water may contain high concentrations of radon. For example, underlying rock such as granite, or phosphate rock, typically have increased uranium and

radium, and therefore radon. While radon easily dissolves into water, it also easily escapes from water when exposed to the atmosphere, especially if it is stirred or agitated. Consequently, radon concentrations are very low in rivers and lakes, but could still be high in water pumped from the ground. Some natural springs, such as those at Hot Springs, Arkansas, contain radon, and were once considered healthful.

### More Info

- [Radon in Water](#)  
This site provides information Public Health Standards for Radon in Drinking Water
- [Radon Home Page](#)  
This site provides information about the hazards and management of radon.
- [EPA Map of Radon Zones](#)  
The purpose of this map is to assist National, State, and local organizations to target their resources and to implement radon-resistant building codes.

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### How does radon change in the environment?

Because radon is a chemically inert (unreactive) gas, it can move easily through rock and soil and arrive at the surface. The half-life of radon-222 is 3.8 days. As it undergoes radioactive decay, radon-222 releases alpha radiation and changes to polonium-218, a short-lived radioactive solid. After several more *transformations* (loss of particles or electromagnetic radiation from the nucleus), the series ends at lead-206, which is stable.

Radon dissolves in water, and easily leaves water that is exposed to the atmosphere, especially if the water is agitated. Consequently, radon levels are very low in rivers and lakes, but water drawn from underground can have elevated radon concentrations. Radon that decays in water, leaves only solid decay products which will remain in the water as they decay to stable lead.

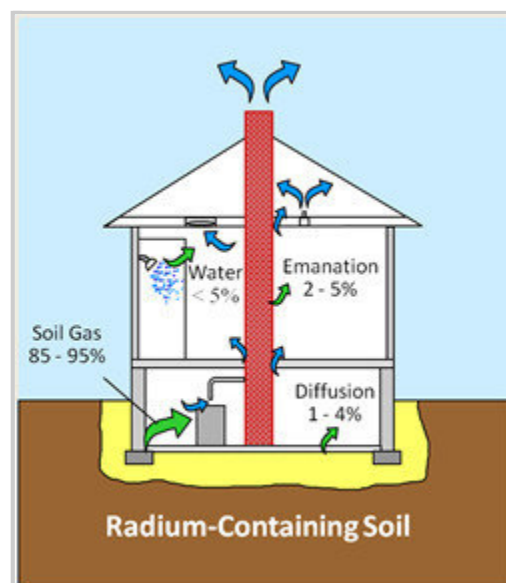
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### How are people exposed to radon?

Most of the public's exposure to natural radiation comes from radon which can be found in homes, schools, and office buildings. The illustration at right shows the sources of radon that can accumulate in buildings.

Most radon in homes comes from radon in the soil that seeps into homes through cracks in the foundation or slab. The amount of radon in the soil varies widely and depends on the chemical make up of the soil. There can be a large difference in radon concentrations in the soil from house to house. The only way to know is to test.

Radon is also found in the water in homes, in particular, homes that have their own well rather than municipal water. When the water is agitated, as when showering or washing dishes, radon escapes into the air. However, radon from water in the home generally contributes only a small



proportion (less than 5%) of the total radon in indoor air in most housing. Municipal water systems hold and treat water, which helps to release radon, so that levels are very low by the time the water reaches our homes. But, people who have private wells, particularly in areas of high radium soil content, may be exposed to higher levels of radon.

EPA estimates that the national average indoor radon level in homes is about 1.3 pCi/l of air. We also estimate that about 1 in 15 homes nationwide have levels at or above the level of 4 pCi/l, the level at which EPA recommends taking action to reduce concentrations. Levels greater than 2,000 pCi/l of air have been measured in some homes. The only way you can know if there is radon in your home is to test for it.

### More Info

- [Radon in Water](#)  
This site provides information Public Health Standards for Radon in Drinking Water.
  - [Radon Home Page](#)  
This site provides information about the hazards and management of radon.
- 

### How does radon get into the body?

People may ingest trace amounts of radon with food and water. However, inhalation is the main route of entry into the body for radon and its decay products. Radon decay products may attach to particulates and aerosols in the air we breathe (for example, cooking oil vapors). When they are inhaled, some of these particles are retained in the lungs. Radon decay products also cling to tobacco leaves, which are sticky, during the growing season, and enter the lungs when tobacco is smoked. Smoke in indoor environments also is very effective at picking up radon decay products from the air and making them available for inhalation. It is likely that radon decay products contribute significantly to the risk of lung cancer from cigarette smoke.

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### What does radon do once it gets into the body?

Most of the radon gas that you inhale is also exhaled. However, some of radon's decay products attach to dusts and aerosols in the air and are then readily deposited in the lungs. Some of these are cleared by the lung's natural defense system, and swallowed or coughed out. Those particles that are retained long enough release radiation damaging surrounding lung tissues. A small amount of radon decay products in the lung are absorbed into the blood.

Most of the radon ingested in water is excreted within hours. There is some risk from drinking water with elevated radon, because radioactive decay can occur within the body where tissues, such as the stomach lining, would be exposed. However, alpha particles emitted by radon and its decay product in water prior to drinking quickly lose their energy and are taken up by other compounds in water, and do not themselves pose a health concern.

---

## Health Effects of Radon

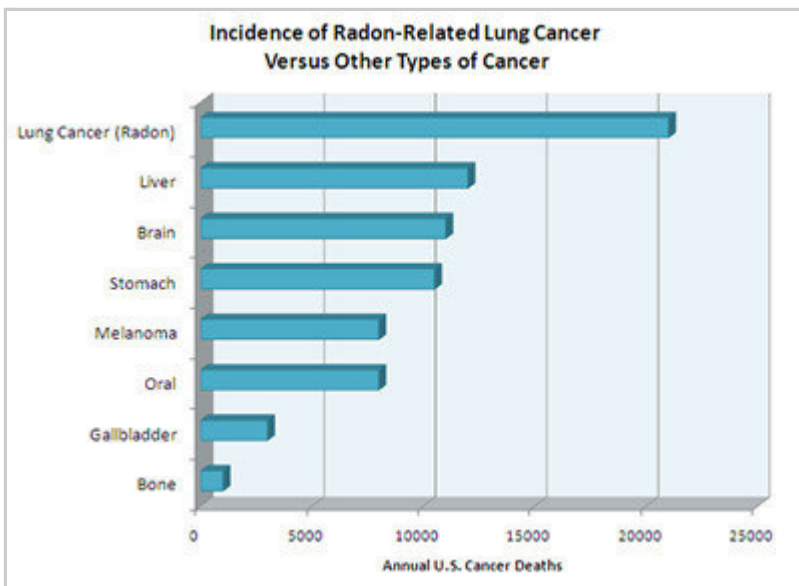
### How can radon affect people's health?

Almost all risk from radon comes from breathing air containing radon and its decay products. The health risk of ingesting (swallowing) radon, in water for example, is much smaller than the risk of inhaling radon and its decay products.

When radon is inhaled, the alpha particles from its radioactive decay directly strike sensitive lung tissue causing damage that can lead to lung cancer. However, since radon is a gas, most of it is exhaled. The radiation dose comes largely from radon's decay products. They enter the lungs on dust particles that lodge in the airways of the lungs. These radionuclides decay quickly, exposing lung tissue to damage and producing other radionuclides that continue damaging the lung tissue.

There is no safe level of radon any exposure poses some risk of cancer. The National Academy of Sciences (NAS) studied and reported on the causes of lung cancer in two 1999 reports. They concluded that radon in indoor air is the second leading cause of lung cancer in the U.S. after cigarette smoking.

The NAS estimated that 15,000-22,000 Americans die every year from radon-related lung cancer. When people who smoke are exposed to radon as well, the risk of developing lung cancer is significantly higher than the risk of smoking alone. The chart at right compares lung cancer cases caused by radon to the incidence of other forms of cancer.



The NAS also estimated that radon in drinking water causes an additional 180 cancer deaths per year. However, almost 90% of those deaths were from lung cancer caused by inhaling radon released to the indoor air from water. Only about 10% of the deaths were from cancers of internal organs, mostly the stomach, caused by ingesting radon in water.

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### Is there a medical test to determine exposure to radon?

Several decay products can be detected in urine, blood, and lung and bone tissue. However, these tests are not generally available through typical medical facilities. Also, they cannot be used to determine accurate exposure levels, since most radon decay products deliver their dose and decay within a few hours.

The best way to assess exposure to radon is by measuring concentrations of radon (or radon decay products) in the air you breathe at home.

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## Protecting People from Radon

### How do I know if there is radon in my home?

You cannot see, feel, smell, or taste radon. Testing your home is the only way to know if you and your family are at risk from radon. EPA and the Surgeon General recommend testing for radon in all homes below the third floor. EPA also recommends testing in schools.

Radon testing is inexpensive and easy to do. It should only take a few minutes of your time. Millions of Americans have already tested their homes for radon. Various low-cost, do-it-yourself test kits are available through the mail and in hardware stores and other retail outlets. You can also hire a trained contractor to do the testing for you.

#### More Info

- [EPA Citizen's Guide to Radon](#)  
This booklet describes commonly available tests for measuring radon concentrations in the home. (See "[What is EPA Doing About Radon?](#)".)
  - [Who Can Test for Fix Your Home](#)  
This page provides contacts for help in finding qualified professionals and do-it-yourself test kits.
- 

### What can I do to protect myself and my family from radon?

The first step is to test your home for radon, and have it fixed if it is at or above EPA's Action Level of 4 picocuries per liter. You may want to take action if the levels are in the range of 2-4 picocuries per liter. Generally, levels can be brought below 2 pCi/l fairly simply.

The best method for reducing radon in your home will depend on how radon enters your home and the design of your home. For example, sealing cracks in floors and walls may help to reduce radon, but is not sufficient. There are also systems that remove radon from the crawl space or from beneath the concrete floor or basement slab that are effective at keeping radon from entering your home. These systems are simple and don't require major changes to your home. Other methods may be necessary.

People who have private wells should test their well water to ensure that radon levels meet EPA's proposed standard.

#### More Info

- [Radon in Drinking Water](#)  
This page provides information on regulations, studies, and state contacts related to radon in drinking water.
  - [Radon](#)  
This page provides access to a wide variety of information and publications on radon and preventing exposure to radon.
  - National Radon Hotline:  
800.767-7236
- 

### What recommendations has the federal government made to protect human health from radon?

Since 1988, EPA and the U.S. Surgeon General have issued Health Advisories recommending that all homes be tested below the third floor for radon. They also recommended fixing homes with radon levels at or above 4 picocuries per liter (pCi/L), EPA's National Voluntary Action Level. EPA and the Surgeon General also recommend that schools nationwide be tested for radon.

#### More Info

- EPA [Radon Publications](#), including:
    - EPA's "A Citizen's Guide to Radon"
    - Consumer's Guide to Radon Reduction
- 

#### What is EPA doing about radon?

EPA has established a voluntary program to promote radon awareness, testing, and reduction. The program sets an 'Action Level' of 4 picocuries per liter (pCi/l) of air for indoor radon. The action level is not the maximum safe level for radon in the home. However, the lower the level of radon, the better. Generally, levels can be brought below 2 pCi/l fairly simply.

In addition to working with homeowners, EPA is working with home builders and building code organizations. The goals are to help newly constructed homes be more radon resistant and to encourage radon testing when existing homes are sold.

#### More Info

- [Radon Resistant New Construction](#)  
This page provides information on radon resistant homes.
- [Radon and Real Estate](#)  
You will find a number of tools and resources use by the real estate community that EPA and its radon partners has developed.

The 1988 Indoor Radon Abatement Act authorizes EPA to provide grants to states to support testing and reducing radon in homes. With various non-governmental and public health organizations, EPA promotes awareness and reduction of indoor radon. Partners include the American Lung Association, the National Environmental Health Association, the American Society of Home Inspectors, and others. The page, [Radon Publications and Resources](#), provides a list of EPA-sponsored publications in English and Spanish.

EPA has also proposed a standard for the maximum amount of radon that may be found in drinking from community water systems using ground water.

#### More Info

- [Proposed Radon Rule](#)  
This rule proposes maximum contaminant levels in drinking water.
- [Indoor Radon Abatement Act](#)  
This act provides grants to states to support the reduction of radon in homes.
- [Radon Publications and Resources](#)  
This is a list of EPA-sponsored publications in English and Spanish.

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## Radiation Protection

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# Thorium

Thorium (chemical symbol Th) is a naturally-occurring radioactive metal found at very low levels in soil, rocks, and water. It has several different isotopes, both natural and man-made, all of which are radioactive. The most common form of thorium is thorium-232, found naturally.

### On this page:

#### The Basics

- [Who discovered thorium?](#)
- [Where does thorium come from?](#)
- [What are the properties of thorium?](#)
- [What is thorium used for?](#)

#### Exposure to Thorium

- [How does thorium get into the environment?](#)
- [How does thorium change in the environment?](#)
- [How are people exposed to thorium?](#)
- [How does thorium get into the body?](#)
- [What does thorium do once it gets into the body?](#)

#### Health Effects of Thorium

- [How can thorium affect people's health?](#)
- [Is there a medical test to determine exposure to thorium?](#)

#### Protecting People From Thorium

- [How do I know if I'm near thorium?](#)
- [What can I do to protect myself and my family from thorium?](#)
- [What is EPA doing about thorium?](#)

### Reference Information

- [People and Discoveries](#)
- [Commonly Encountered Radionuclides](#)
  - [Americium-241](#)
  - [Cesium-137](#)
  - [Cobalt-60](#)
  - [Iodine-129 &-131](#)
  - [Plutonium](#)
  - [Radium](#)
  - [Radon](#)
  - [Strontium-90](#)
  - [Technetium-99](#)
  - [Tritium](#)
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## The Basics

### Who discovered thorium?

Thorium was discovered in 1828 by the Swedish chemist Jons Jakob Berzelius. After determining that it was a new element, Berzelius named his discovery after the Norse god of

thunder and weather, Thor. Thorium was discovered to be radioactive independently in 1898 by Gerhard Carl Schmidt and by Marie Curie.

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### **Where does thorium come from?**

Almost all thorium is natural, but, thorium isotopes can be artificially produced. Thorium occurs at very low levels in virtually all rock, soil, and water, and therefore is found in plants and animals as well. Minerals such as monazite, thorite and thorianite are rich in thorium and may be mined for the metal. Generally, artificial isotopes come from decay of other man-made radionuclides, or absorption in nuclear reactions.

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### **What are the properties of thorium?**

Thorium is a soft, silvery white metal. Pure thorium will remain shiny for months in air, but if it contains impurities it tarnishes to black when exposed to air. When heated, thorium oxide glows bright white, a property that makes it useful in lantern mantles. It dissolves slowly in water. Thorium-232 has a half-life of 14 billion ( $14 \times 10^9$ ) years, and decays by alpha emission, with accompanying gamma radiation. Thorium-232 is the top of a long decay series that contains key radionuclides such as radium-228, its direct decay product, and radon-220. Two other isotopes of thorium, which can be significant in the environment, are thorium-230 and thorium-228. Both belong to other decay series. They also decay by alpha emission, with accompanying gamma radiation, and have half-lives of 75,400 years and 1.9 years, respectively.

---

### **What is thorium used for?**

Thorium has coloring properties that has made it useful in ceramic glazes. But, it has been most widely used in lantern mantles for the brightness it imparts (though alternatives are replacing it), and in welding rods, which burn better with small amounts of added thorium. Thorium improves the properties of ophthalmic lenses, and is an alloying agent in certain metals used in the aerospace industry. More than 30 years ago, thorium oxides were used in hospitals to make certain kinds of diagnostic X-ray photographs. But, this practice has been discontinued.

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## **Exposure to Thorium**

### **How does thorium get into the environment?**

Natural thorium is present in very small quantities in virtually all rock, soil, water, plants and animals. Where high concentrations occur in rock, thorium may be mined and refined, producing waste products such as mill tailings. If not properly controlled, wind and water can introduce the tailings into the wider environment. Commercial and federal facilities that have processed thorium may also have released thorium to the air, water, or soil. Man-made thorium isotopes are rare, and almost never enter the environment.

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## **How does thorium change in the environment?**

As thorium-232 undergoes radioactive decay, it emits an alpha particle, with accompanying gamma radiation, and forms radium-228. This process of releasing radiation and forming a new radionuclide continues until stable lead-208 is formed. The half-life of thorium-232 is about 14 billion years. Two other isotopes of thorium, which can be significant in the environment, are thorium-230 and thorium-228. Both decay by alpha emission, with accompanying gamma radiation, in 75,400 years and 1.9 years, respectively.

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## **How are people exposed to thorium?**

Since thorium is naturally present in the environment, people are exposed to tiny amounts in air, food and water. The amounts are usually very small and pose little health hazard. Thorium is also present in many consumer products such as ceramic glazes, lantern mantles, and welding rods.

People who live near a facility that mines or mills thorium, or manufactures products with thorium, may receive higher exposures. Also, people who work with thorium in various industries may receive higher exposures.

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## **How does thorium get into the body?**

People may inhale contaminated dust, or swallow thorium with food or water. Living near a thorium contaminated site, or working in an industry where thorium is used, increases your chance of exposure to thorium.

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## **What does thorium do once it gets into the body?**

If inhaled as dust, some thorium may remain in the lungs for long periods of time, depending on the chemical form. If ingested, thorium typically leaves the body through feces and urine within several days. The small amount of thorium left in the body will enter the bloodstream and be deposited in the bones where it may remain for many years. There is some evidence that the body may absorb thorium through the skin, but that would not likely be the primary means of entry.

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## **Health Effects of Thorium**

### **How can thorium affect people's health?**

The principal concern from low to moderate level exposure to ionizing radiation is increased risk of cancer. Studies have shown that inhaling thorium dust causes an increased risk of developing lung cancer, and cancer of the pancreas. Bone cancer risk is also increased because thorium may be stored in bone.

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### **Is there a medical test to determine exposure to thorium?**

There are special tests that measure the level of thorium in the urine, feces, and also via exhaled air that can determine if a person has been exposed to thorium. These tests are useful only if taken within a week after exposure. You need special equipment to detect thorium not available in doctors offices or most hospitals. Some federal facilities and specialized laboratories have this capability.

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## Protecting People from Thorium

### How do I know thorium if I'm near thorium?

You need special equipment to detect thorium, and special training. Health physicists and radiation safety officers are trained to measure thorium.

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### What can I do to protect myself and my family from thorium?

Most people are not exposed to dangerous levels of thorium. However, people who live near thorium mining areas, or near certain government or industrial facilities may have increased exposure to thorium, especially if their water is from a private well. Analytical laboratories can test water for thorium content. Occasionally, household items may be found with thorium in them, such as some older ceramic wares in which uranium was used in the glaze, or gas lantern mantles. These generally do not pose serious health risks, but may nevertheless be retired from use as a prudent avoidance measure. A radiation counter is required to confirm if ceramics contain thorium.

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### What is EPA doing about thorium?

EPA protects people and the environment from thorium by establishing standards for the clean-up of contaminated sites, and by setting limits on the amount of thorium (and other radionuclides) that may be released to the air from specific sources, or found in public drinking water.

The standards for the clean-up of existing contaminated sites generally fall under the Comprehensive Environmental Response, Compensation, and Liability Act, commonly called Superfund. Clean ups must meet all requirements that are relevant or applicable, such as state regulations and regulations issued in connection with other environmental laws. When these types of regulations are not applicable, or not protective enough, EPA sets site-specific cleanup levels that limit the chance of developing cancer due to exposure to a site-related carcinogen (such as thorium) to between one in 10,000 and one in 1,000,000.

EPA issued special regulations for cleaning up uranium and thorium mill tailing sites under the "Uranium Mill Tailings Radiation Control Act" (federal regulations are found in 40CFR192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings"). These mills are found mostly in the western states of Colorado, Utah, Arizona and New Mexico.

- [Superfund: EPA Radiation Guidances and Reports](#)  
This site provides information on radionuclides at Superfund sites.

- EPA's Superfund Hotline: 1-800-424-9346 or 1-800-535-0202
- Clean Air Act  
EPA uses this authority to set limits on the emissions of hazardous air pollutants from specific sources. Hazardous air pollutants include both chemicals and radionuclides that are known or suspected to cause serious health problems. While no air emissions standards list thorium specifically, radionuclides are limited as a group.
  - RadNESHAPS  
This site provides information on EPA's National Emission Standards for Hazardous Air Pollutants: Radionuclides.
- Radionuclides in Drinking Water  
This site provides information about radionuclides in drinking water and guidance to help states and water systems comply with the standard. EPA uses its Safe Drinking Water Act authority to establish maximum contaminant levels (MCLs) for alpha emitters such as thorium in public drinking water. The MCL for alpha emitters is 15 picoCuries per liter of water.


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Understanding Radiation in Your Life, Your World

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**ATTACHMENT B**

WESTON FLDS

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			Initial Issue Date	April 2011
			Revision Date:	Initial Version
FLD01 Occupational Noise and Hearing Conservation Program			Revision No.	0
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## 7.0 OCCUPATIONAL NOISE AND HEARING CONSERVATION PROGRAM

Noise can cause sudden traumatic temporary or permanent hearing loss, long-term slowly occurring sensory-neural and irreversible hearing loss, disruption of communication, and masking of warning devices and alarms. Additional concerns include increased stress levels and effects on the cardiovascular and nervous systems. This Program describes the process for controlling, reducing, and minimizing noise exposure.

WESTON's OMP will assist in compliance with this Program through evaluation of clinics, verification of baseline exams, and employee audiogram evaluation. The OMP will advise the appropriate Safety Officer and, if necessary, the CEH&S Director of any problems associated with medical compliance or occupationally related hearing loss in workers.

The need for noise-monitoring equipment, noise dosimeters or hearing protection devices must be addressed in the planning stages of a project. Some of the sources of noise at hazardous materials sites, demolition operations, construction and industrial sites which can cause hearing damage are: earth moving equipment (front end loader, bull dozer), material handling equipment (cranes, industrial trucks), power units (compressors, generators drill rig engines), impact devices (pile drivers, chipping hammers), and other powered devices (saws, needle guns, drills, vibrating equipment).


### 7.1 NOISE EVALUATION AND SURVEILLANCE PROCEDURES

OSHA in 29 CFR 1910.95, establishes a PEL, time weighted average (TWA) of 90 dBA for an 8-hour work day and a TWA of 85 dBA as the trigger point (action level or AL) for establishing a Hearing Conservation Program (HCP). The HCP includes baseline and annual hearing tests, and hearing conservation training.

Noise exposure can also be compared to the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV). The TLVs for noise are arranged in a scale in dBs related to time periods. For an 8-hour work period the TWA TLV is 85 dBA, and the AL is 80 dBA. The ACGIH numbers are more conservative and realistically reflect current scientific knowledge on the human effects from noise exposure. Therefore, WESTON will use the ACGIH TLVs and Guidance and the 3 dB exchange rate as the basis for WESTON's HCP to provide a higher level of protection for our employees than that offered by compliance with the OSHA requirements which are several dB higher.

Noise exposure assessment is performed only by qualified personnel with properly calibrated and functional noise measuring equipment. If the HASP or the FSO indicates that the site, or activity, requires an instrumentation survey then the area will be screened with an A-weighted sound level meter (Area Monitoring). If deemed necessary a more in depth evaluation utilizing a noise dosimeter may be performed (Personnel Monitoring). Both types of monitoring, if needed, will be accomplished in accordance with requirements established in 29 CFR 1910.95(d).

In the absence of sound level measuring instrumentation, any noise preventing normal vocal discussion between two individuals at arm's length distance ("arms-length rule") will dictate the need for hearing protection. WESTON guidelines require the use of hearing protection on an immediate basis under the "arms-length rule". Exceptions may be granted based upon evaluation of a specific task and duration with consultation with an industrial hygienist.

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Long-term work efforts at fixed locations (e.g., water treatment plants, incinerators) require an evaluation of noise levels. Re-monitoring may be necessary when changes in equipment, processes, or activities result in modification of the noise level.

If impact noise is present, the peak noise levels and the frequency of the impacts should be determined. OSHA and AGCIH recommendations and/or qualified personnel should be consulted if questions arise regarding impact or impulse noise.

## 7.2 NOISE CONTROL METHODS

### Engineering Controls

The primary means of reducing or eliminating personnel exposure to noise is through engineering controls. Engineering controls are defined as any modification or replacement of equipment, or related physical change at the noise source or along the sound transmission path that will reduce the noise level to the employee's ear. Engineering controls include items such as; mufflers on heavy equipment or motors, sound baffles, and enclosures.

### Administrative Controls


Administrative controls may include changes in the work schedule or operations to reduce noise exposure, increasing worker distance from the noise source, and rotation of jobs to reduce time limits of exposure. Administrative time control is not a preferable method for preventing noise exposure since extreme noise for a short duration can cause severe, permanent hearing loss. Administrative controls may be utilized in accordance with the TLV Table ACGIH TLVs and Biological Exposure Indices (BEIs), 2007 Edition. Administrative controls may not be utilized for exposures greater than 100 dBA, regardless of the exposure time.

### Hearing Protection

Hearing protection devices are utilized whenever engineering controls prove to be infeasible or cost prohibitive. Various types of ear muffs and ear plugs are available. Hearing protector attenuation is intended to reduce employee exposures below 80 dBA for employees with standard threshold shifts and below 85 dBA for all other employees.

WESTON personnel and WESTON subcontractors must wear hearing protection devices (HPDs) when required and where signs are posted requiring their use. Hearing protection devices are strongly recommended in any noisy environment, but are mandatory in the following situations:

- The 8-hour average may equal or exceed 85 dBs.
- Any employee exposed to greater than or equal to 85 dBs and who have experienced a standard threshold shift in their hearing.
- Any noise equal to greater than 100 dBs impact, continuous or intermittent.
- Anywhere a "HEARING PROTECTION REQUIRED" sign is posted. These signs are to be posted in all mandatory situations listed above.

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In addition when noise levels equal or exceed 80 dBA employees must have:

- Availability of hearing protectors.
- Information and training on effects of noise.
- Availability of audiometric testing where there is a risk to health.

Not all hearing protection devices have the same noise reduction rating (NRR). Verification of all NRR values must be made by referring to the manufacturers' specifications. The proper hearing protection is selected using results from a properly calibrated sound level meter in accordance with ACGIH TLVs and BEIs, 2007 Edition.

Additional information regarding the selection, use, maintenance, and control of hearing protection devices is provided in the WESTON Personal Protective Equipment Program (Section 5.0).

NRR will be adjusted using the following to estimate the attenuation afforded to a noise-exposed employee in a work environment by muffs, plugs, or a combination of both:

### **Single Protection**

A common formula used to estimate exposure for **single protection** (either muffs or plugs) follows:

1. Determine the laboratory-based noise attenuation provided by the HPD. This is referred to as the NRR and is listed on the packaging.
2. Subtract the NRR from the C-weighted TWA workplace noise level, as follows:

$$\text{Estimated Exposure (dBA)} = \text{TWA (dBC)} - \text{NRR}$$

If C-weighted noise level data are not available, A-weighted data can be used by subtracting a 7 dB correction factor from the NRR, as follows:

$$\text{Estimated Exposure (dBA)} = \text{TWA (dBA)} - (\text{NRR} - 7)$$

*Example:*


TWA=100 dBA, muff NRR=19 dB

Estimated Exposure = 100 - (19-7) = 88 dBA

### **Dual Protection**

A common formula used to estimate exposure for **dual protection** (ear muffs and plugs are used simultaneously) follows:

1. Determine the laboratory-based NRR for the **higher** rated protector ( $\text{NRR}_h$ ).
2. Subtract 7 dB from  $\text{NRR}_h$  if using A-weighted sound level data.
3. Add 5 dB to the field-adjusted NRR to account for the use of the second hearing protector.

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4. Subtract the remainder from the TWA as follows:

**Estimated Exposure (dBA) = TWA (dBC) - (NRR<sub>h</sub> + 5) or**

**Estimated Exposure (dBA) = TWA (dBA) - [(NRR<sub>h</sub> - 7) + 5]**

*Example:*

TWA=110 dBA, plug NRR=29, and muff NRR=25 dB

Estimated Exposure = 110 - [(29 - 7) + 5] = 83 dBA

### 7.3 MEDICAL SURVEILLANCE

Compliance with the HCP is required when an employee's exposure to noise is in excess of 85 dBA. Employees who work with drill rigs, heavy construction equipment, or noisy client operations are candidates for the HCP and medical surveillance requirements thereof. Supervisors of any employees who do not meet these categories but who work around excessive noise (e.g., treatment plant operations, print shop, maintenance personnel) must perform noise surveys to determine the need for those employees to participate in the HCP, and advise the safety officer who will notify the OMP.

WESTON's OMP will make the final determination of employee involvement in the medical surveillance component of the HCP. Audiometric testing is performed annually to evaluate the hearing of all individuals who are routinely exposed to 8-hour TWA exposures of 85 dBA or greater (including compliance with the "arms-length rule"). WESTON's OMP is responsible for assuring local clinic compliance with the audiometric testing component of the standard.


### 7.4 TRAINING

Training is regularly provided during WESTON's initial and refresher courses under 29 CFR 1910.120 (HAZWOPER). Alternative training will be given to employees who are included in the HCP but are not required to have HAZWOPER training. Initial and annual training shall be given to each employee included in the HCP and address the following:

- The effects of noise on hearing.
- The purpose of hearing protection, advantages, disadvantages, attenuation of various types, and the selection, fitting, use, and care of protectors.
- The purpose of audiometric tests and explanation of test procedures.
- Recognition of hazardous noise.

### 7.5 PROGRAM EVALUATION

Periodic program evaluations will be conducted to assess compliance with 29 CFR 1910.95. WESTON's OMP is responsible for assisting in this evaluation by providing information relative to employee exposure and medical surveillance data.

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## 7.6 RECORDKEEPING

Employee exposure measurements are retained for a minimum of two years and audiometric test records are retained for the duration of the employee's employment, plus 30 years.

## 7.7 REFERENCES

29 CFR 1910.95, Occupational Noise Exposure

American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Value (TLV) for Chemical Substances and Physical Agents, 2007

## FLD 02 INCLEMENT WEATHER

Hot weather (ambient temperatures over 70°F), cold weather (ambient temperatures below 40°F), rain, snow, ice, and lightning are examples of inclement weather that may be hazardous or add risk to work activities. Extremes of heat, cold, and humidity, as well as rain, snow, and ice, can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials.

### RELATED FLDs AND OP

*FLD 05 – Heat Stress Prevention and Monitoring*

*FLD 06 – Cold Stress*

*OP 05-03-008 – Inclement Weather & Business Disruption Policy*

### PROCEDURE

The potential for exacerbating the impact of physical hazards must be considered for tasks that expose personnel to inclement weather. Risk assessment and hazards analysis should be accomplished during the planning stages of a project for the most likely inclement weather conditions that may be encountered, i.e., rain and lightning in late spring, summer, and early fall, or lightning prone areas; cold, snow, and ice in winter. The Field Safety Officer (FSO) must determine the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his/her work and be actively alert to these hazards. Managers and workers must be familiar with the requirements of FLD 05 and FLD 06.

A pre-site activity risk assessment must be completed when inclement weather occurs. Weather conditions that affect instruments and personal protective equipment (PPE) function must be conveyed to site workers who should monitor function and integrity of PPE and be alert to changing weather conditions. A decision must be made on the proper safety procedures to use if work must continue, or to stop work if the risk is too great. The appropriate Safety Professional **must be notified of all instances of the need to stop work for safety reasons, including inclement weather.**

### Heat

Hot, dry weather increases risk of soil drying, erosion, and dust dispersion, which may present or increase risk of exposure and environmental impact from toxic hazards. Hot weather will increase pressure on closed containers and the rate of volatilization, thereby potentially increasing the risk of exposure to toxic, flammable, or explosive atmospheres.

#### Prevention and Protective Measures

Employees must be protected from airborne contaminants using engineering controls such as wetting dry soil to prevent particle dispersion, and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed PPE. Wind shifts and velocity should be measured where change may result in dispersion of airborne contaminants into the work area.

### Rain, Wet Weather, and High Humidity

Wet conditions resulting from rain and wet weather increase slipping and tripping hazards, braking distances of vehicles, the potential for vehicle skidding, or difficulties in handling powered devices such as augers and drills. Rain fills holes, obscures trip and fall hazards, and increases risk of electrical shock

when working with electrical equipment. Changes in soil conditions caused by rain can impact trenching and excavating activities, creating the potential for quicksand formation, wall collapse, and cave-in. Vehicles become stuck in mud, and tools and personnel can slip on wet surfaces. Rain and wet conditions may decrease visibility (especially for personnel wearing respiratory protection) and limit the effectiveness of certain direct-reading instruments (e.g., photoionization detectors [PIDs]).

Feet that become wet and are allowed to remain wet can lead to serious problems under both heat and cold conditions. Activities that may result in wet feet include extended work in chemical protective clothing and wading in water/liquid during biological assessments. Trench foot, paddy foot, and immersion foot are terms associated with foot ailments resulting from feet being wet for long periods of time. All have similar symptoms and effects. Initial symptoms include edema (swelling), tingling, itching, and severe pain. These may be followed by more severe symptoms including blistering, death of skin tissue, and ulceration. (NOTE: The following Preventive and Protective Measures also apply to Cold, Snow, and Ice.)

### Preventive and Protective Measures

Walkways, stairs, ladders, elevated workplaces, and scaffold platforms must be kept free of mud, ice, and snow. Employees shall be prohibited from working on scaffolds covered with snow, ice, or other slippery material except as necessary for removal of such materials.

Vehicles used in rain or cold weather must have working windshield wipers and defrosters, and windows must be kept clear of obstruction.

Drivers must observe traffic laws, including maintaining speed within limits safe for weather conditions, and wearing seat belts at all times. Note that this may mean operating below the posted speed limit.

When walking, workers should use a walking stick or probe to test footing ahead where there is standing water, snow, or ice to protect the walker against stepping into potholes or onto puncture hazards, buried containers, or other potential structurally unsound surfaces.

Prior to using vehicles or equipment in off-road work, workers should walk the work area or intended travelway when puddles or snow may obscure potholes, puncture hazards, or buried containers, or other potential structurally unsound surfaces.

Project managers should arrange to have winches, come-alongs, or other mechanical assistance available when vehicles are used in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load, and be inspected regularly and before use to ensure safety. **Manually pushing stuck vehicles is to be avoided.**

Prevention methods are required when work is performed in wet conditions or when conditions result in sweating, causing the feet to become and remain wet. Proper hygiene is critical. Workers must dry their feet and change socks regularly to avoid conditions associated with wet feet. Use of foot talc or powder can additionally assist in prevention of this type of condition.

### **Cold, Snow, and Ice**

Cold weather affects vehicle operation by increasing difficulty in starting and braking. Ice, frost, and snow can accumulate on windows and reduce vision. Cold, wet weather can cause icing of roadways,

driveways, parking areas, general work places, ladders, stairs, and platforms. Ice is not always as obvious to see as snow or rain, and requires special attention, especially when driving or walking.

Snow and ice increase the risk of accidents such as slipping when walking, climbing steps and ladders, or working at elevation, and the risk of accidents when driving vehicles or operating heavy equipment. Heavy snow and ice storms may cause electric lines to sag or break, and the use of electrical equipment in snow increases the risk of electric shock. Snow can hide potholes and mud, which can result in vehicles getting stuck or persons falling when stepping into hidden holes. Snow also may cover water, drums or other containers, sharp metal objects, debris, or other objects that can cause falls or punctures.

### Preventive and Protective Measures

WESTON personnel are cautioned against operating motor vehicles such as cars or trucks on ice under any circumstances. If traveling in icy conditions, WESTON personnel should follow all public service advisories that curtail driving activities.

Personnel performing activities that require working over ice should be aware of minimal ice thickness safety guidelines as follows:

- 4-inch minimum: activities such as walking or skating.
- 6-inch minimum: activities such as snowmobiling or the use of equipment with the same weight and cross-sectional area as a snowmobile.

Personnel should always be aware that these measurement guidelines are under ideal conditions and that snow cover, conditions on rivers, ponds, or lakes with active currents, and other environmental factors impact the safety of working on ice. Clear ice typically is the strongest, while ice that appears cloudy or honeycombed (contains entrained air) is not as structurally strong. Measurements made by drilling or cutting through the ice should be made every few feet to verify safe conditions. Provisions for rescue (e.g., ladders or long poles and effective communications) must be available at the work site.

## **Lightning**

Lightning represents a hazard of electrical shock that is increased when working in flat open spaces, elevated work places, or near tall structures or equipment such as stacks, radio towers, and drill rigs. Lightning has caused chemical storage tank fires and grass or forest fires. Static charges associated with nearby electrical storms can increase risk of fire or explosion when working around flammable materials, and can adversely affect monitoring instruments.

Lightning is the most dangerous and frequently encountered weather hazard people experience each year. Lightning affects all regions. **Florida, Michigan, Pennsylvania, North Carolina, New York, Ohio, Texas, Tennessee, Georgia, and Colorado** have the most lightning deaths and injuries.

### Preventive and Protective Measures

Prior to working in areas or beginning projects when or where there is an increased potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes. Recommendations include:

- Check with client management to determine if there are any patterns or noted conditions that can help predict lightning or if there are structures that are prone to lightning strikes. Arrange for

client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.

- Monitor weather reports.
- Note weather changes and conditions that produce lightning.
- Stop work in open areas, around drill rigs or other structures that may attract lightning, on or in water and in elevated work places when lightning strikes are sighted or thunder is heard near a work site.
- Ensure all personnel are provided with safe areas of refuge. Prevent personnel from standing in open areas, under lone trees, or under drill rigs.
- Observe the “30-30” Rule. If you see lightning and thunder is heard within 30 seconds (approximately 6 miles), seek shelter. If you hear thunder, but did not see the lightning, you can assume that lightning is within 6 miles and you should seek shelter. Remain in the sheltered location for 30 minutes following the last lightning strike.
- Use a hand held static potential meter (lightning detection device) to monitor the potential difference between a cloud and the ground. When the measured potential is greater than 2 kV/m, there is a potential for a lightning strike – seek shelter.

## **High Wind and Tornado Safety**

### High Winds

Many construction workers have died due to wind-related accidents and injuries. A ladder that seems secure under normal circumstances can become unstable during windy conditions and cause you to fall. Scaffolding that is improperly secured can rip free during strong winds and kill bystanders. The risk of injury for construction workers increases during strong winds. Keep in mind that changing weather conditions can affect your daily work tasks, and make sure you have a game plan to prevent proper damage and personal injury.

Stay Informed: With today’s modern technology available at the touch of a button, you should keep up to date with the latest local weather reports. Visit [weatherbug.com](http://weatherbug.com) or [weather.gov](http://weather.gov) to stay informed in case of wind warnings, watches, and advisories. Larger projects may have their own weather station on site to provide instant weather data. Use daily hazard assessments to determine if working conditions have changed or will change throughout the day.

Be Prepared: When you know the weather will be windy, secure loose building materials, scaffolding and fencing that could be picked up or torn loose by strong winds and thrown onto surrounding streets, structures, vehicles, or bystanders.

Know the Limits of Your Equipment: When operating any equipment, take time to read the operator’s manual and become familiar with the wind specifications. Many crane manufacturers have high-wind guidelines to prevent you from operating a crane in unsafe weather. You should also check safety equipment such as fall protection to determine if it is adequate for windy conditions.

## Know the Terminology

### Severe Thunderstorm Watch

A Severe Thunderstorm Watch means that strong thunderstorms capable of producing winds of 58 mph or higher and/or hail 3/4 inches in diameter or larger are possible. If you are in the area of a Severe Thunderstorm Watch, you should be prepared to take shelter from thunderstorms. Severe Thunderstorm Watches are generally issued for 6-hour periods.

### Severe Thunderstorm Warning

A Severe Thunderstorm Warning means that thunderstorms capable of strong winds and/or large hail are occurring or could form at any time. If you are in the area of a severe thunderstorm, you should take shelter indoors immediately, avoid windows, and be prepared for high winds and hail. Severe Thunderstorm Warnings are generally in effect for an hour or less.

### High Wind Watch

A High Wind Watch is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are likely to develop in the next 24 to 48 hours. For summit areas, high wind watches are issued when sustained winds are expected to exceed 45 mph and/or frequently gust over 60 mph. If you are in an area for which a High Wind Watch has been issued you should secure loose objects outdoors that may blow about and avoid outdoor activity that exposes you to high winds.

### High Wind Warning

A High Wind Warning is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are occurring or imminent. For summit areas, warnings are issued for winds exceeding 45 mph and/or frequently gusting over 60 mph. Wind warnings may issued up to 24 hours ahead of the onset of high winds and remain in effect for 6 to 12 hours. If you are in an area where a high wind warning is in effect you should avoid activities that expose you to high winds. Loose objects may be blown around. Tree limbs may break and fall. Power lines may be blown down.

### Wind Advisory

A Wind Advisory is issued when sustained winds of 30 to 39 mph and/or frequent gusts to 50 mph or greater are occurring or imminent. Wind advisories may be in effect for 6 to 12 hours. If you are in an area where a wind advisory is in effect you should secure loose objects that may be blown about outdoors and limit activity that may expose you to high winds.

Work Safely: If you will be working on a windy day, you should be alert and protected. Wear eye protection to prevent dust and other particles from entering or striking your eyes. Keep your hard hat on at all times to prevent injuries from falling or flying objects. The likelihood of falls from heights is greatly increased by strong winds. Wear the necessary PPE to ensure your safety.

To avoid flying debris and to minimize damage during high winds:

- Shut down outdoor activities involving work at elevation on ladders, scaffolding, aerial lifts, etc.; handling large tarps and plastic sheeting when wind speeds exceed 25 mph; including work with radioactive materials and highly toxic materials that could be dispersed by the winds.
- At 13 - 18 mph wind will raise dust. Follow the dust action level.

- Move mobile items stored outside to indoor storage.
- Secure any items that cannot be moved inside.
- Be careful opening exterior doors.
- Be cautious about downed power lines, tree limbs, and debris on roads.
- Be alert for animals who have escaped from farms and zoos.

Stay Away from Power Lines: High winds can cause tree limbs to fall on power lines resulting in electrocution hazards or loss of power. Your best bet is to keep your distance.

## Tornados

### What is a TORNADO?

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm or as a result of severe weather associated with hurricanes. A funnel cloud is formed as cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado results from high wind velocity and wind blown debris.

### Tornado Safety

When a tornado approaches, you have only a brief amount of time to make life-or-death decisions. Advance planning and quick response are the keys to surviving a tornado.

Purchase a NOAA Weather Alert radio with an alert feature. When tuned to the proper frequency, these weather radios remain silent until a weather emergency occurs. Once they pick up the alarm tone, they will begin broadcasting emergency weather information so that citizens can protect themselves and their property. Some models of the NOAA weather radio incorporate the Specific Area Message Encoder technology, allowing users to target only those warnings that affect their immediate geographic area.

Conduct tornado drills. Designate an area to serve as your safe area, and practice having team members assemble there in response to a mock tornado warning.

Emergency Communications Plan. Develop an emergency communications plan in case team members are separated from one another when a tornado warning goes into effect. Designate an emergency coordinator. Instruct everyone to contact this coordinator in a weather emergency for instructions on what to do during the storm and where to reassemble after the emergency has passed. Design contingency plans to be consistent with client contingency plans. When possible use client warning and alerting systems and confirm that team members have access to shelters and know how to get to them.

### Know the Difference between a Tornado Watch and a Tornado Warning

Tornado Watch: Issued by the National Weather Service when tornadoes are possible in your area. You should remain alert for approaching storms. Remind family members of where the safe areas are within your home, and carefully monitor radio or television reports for further developments.

Tornado Warning: Indicates that a tornado has been sighted in your area, or is indicated on weather radar. You should proceed to safe shelter immediately.

*When A Tornado Warning Goes In Effect, Put Your Safety Plans In Action.*

**In Your Automobile:** Motor vehicles are easily overturned by tornado winds. Leave your vehicle and seek shelter in a sturdy building. As a last resort, seek shelter in a ditch or culvert. Do not try to outrun or outmaneuver a tornado! Use the time to seek appropriate shelter outside your vehicle.

**Office Buildings, Hotels, and Shopping Centers:** Take shelter in an interior hallway on a lower floor. A closet, bathroom or other small room with short, stout walls will give some protection from collapse and flying debris. Otherwise, get under heavy furniture and stay away from windows. Many tornado deaths have occurred in large buildings due to the collapse of a roof or wide span wall. A corner area, away from a window, is safer than the middle of a wide span wall.

**Out In Open Country:** When severe weather approaches, seek inside shelter immediately. The chances of encountering falling trees, downed power lines and lightning are far greater than encountering a tornado itself. If a tornado approaches, lie flat in the nearest depression, such as a culvert or ditch, and cover your head with your arms.

**BE ALERT TO CHANGING WEATHER CONDITIONS**

**HAVE AN EMERGENCY WEATHER PLAN IN PLACE**

**REHEARSE YOUR CONTINGENCY PLANS PERIODICALLY**

**KNOW WHERE TO GO WHEN A TORNADO THREATENS.**

## **FLD 05 HEAT STRESS PREVENTION AND MONITORING**

Heat stress may occur at any time work is performed at elevated temperatures. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur such as fatigue, irritability, anxiety, and decreased concentration or dexterity, and possibly death. Because heat stress is one of the most common and potentially serious illnesses at field sites, regular monitoring and other preventive measures are vital to ensure worker safety. Wearing chemical protective clothing often decreases natural body heat loss (cooling) and increases the risk of heat stress.

Employees who are taking prescription or over-the-counter medications should consult with their personal physician prior to working in high-temperature environments to see if their medication would impair their ability to handle heat stress.

### **REFERENCES**

OSHA 29 CFR 1910 and 1926

### **RELATED FLDs**

*FLD 02 – Inclement Weather*

*FLD 03 – Hot Processes – Steam, Low Temperature Thermal Treatment Unit, and Transportable Incinerator*

*FLD 08 – Confined Space Entry Program*

*FLD 36 – Welding/Cutting/Brazing/Radiography*

*FLD 37 – Pressure Washers/Sandblasting*

### **PROCEDURE**

#### **Heat Stress Symptoms and Treatment**

##### Heat Rash

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation and is aggravated by chafing clothes. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance.

Symptoms – Mild red rash, especially in areas of the body that come into contact with protective gear.

Treatment – Decrease amount of time spent working in protective gear and provide body powder to help absorb moisture and decrease chafing. Heat rash can be prevented by showering, resting in a cool place, and allowing the skin to dry.

##### Heat Cramps

Heat cramps are caused by inadequate electrolyte intake. The individual may be receiving adequate water; however, if not combined with an adequate supply of electrolytes, the blood can thin to the point where it seeps into the active muscle tissue, causing cramping.

Symptoms – Acute painful spasms of voluntary muscles, most notably the abdomen and extremities.

*Treatment* – Move the victim to a cool area and loosen clothing. Have the victim drink 1 to 2 cups of cool potable water or diluted commercial electrolyte solution (e.g., Gatorade, Quench) immediately, and then every 20 minutes thereafter until symptoms subside. Electrolyte supplements can enhance recovery; however, it is best to double the amount of water required by the dry mix package directions or add water to the liquid form.

### Heat Exhaustion

Heat exhaustion is a state of weakness or exhaustion caused by the loss of fluids from the body. Heat exhaustion is not as dangerous as heat stroke, but if not properly managed in the field it may lead to heat stroke.

*Symptoms* – Pale, clammy, and moist skin, profuse perspiring, and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, may feel dizzy, and may be irritable or confused.

*Treatment* – Move the victim to a cool, air-conditioned or temperature-controlled area, loosen clothing, place in a position with the head lower than the feet (shock prevention), and allow the victim to rest. Consult a physician. Ensure that the victim is not nauseated or vomiting. If not nauseated or vomiting, give the victim small sips of cool water or diluted electrolyte replenishment solution (one to one dilution with water, or if mixing from powder, double the water added). If this is tolerated, have the victim drink 1 to 2 cups of fluid immediately, and every 20 minutes thereafter until symptoms subside. Seek medical attention at the advice of the consulting physician.

### Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the body's heat regulating mechanisms, i.e., the individual's temperature control system (sweating) stops working correctly. Body temperature rises so high that brain damage and death may result if the person is not cooled quickly.

*Symptoms* – Red, hot, dry skin (although the person may have been sweating earlier); nausea, dizziness, confusion, extremely high body temperature (i.e., 104°F or greater as measured with an oral thermometer), rapid respiratory and pulse rate, seizures or convulsions, unconsciousness or coma.

*Treatment* – Immediately call for emergency medical assistance. Remove the victim from the source of heat and cool the victim quickly. If the body temperature is not brought down quickly, permanent brain damage or death may result. Remove all PPE and as much personal clothing as decency permits. Fan the person while sponging or spraying with cool or tepid water. Apply ice packs (if available) to the back of the neck, armpits, groin area, or behind the knees. Place the victim flat on their back or with head and shoulders slightly elevated. If conscious, and not nauseated or vomiting, the victim may be provided sips of cool water. Do not give the victim coffee, tea, or alcoholic beverages. Emergency medical personnel will take over treatment when they arrive.

## **Recognition and Risk Assessment**

In the planning stages of a project, the potential for heat stress disorders must be considered as a physical hazard in the site-specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely heat stress disorders that may occur. The Field Safety Officer (FSO) must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not

followed or the risk is too great. In addition, all site personnel must be aware of these symptoms in both themselves and their co-workers.

### **Prevention and Protection Programs**

Heat stress is affected by several interacting factors including, but not limited to, age, obesity, physical condition, substance abuse, level of personal protective equipment (PPE) worn, and environmental conditions (temperature, shade, and humidity). Site workers must learn to recognize and treat the various forms of heat stress. The following recommendations should be followed to prevent heat stress:

- The most important measure to prevent heat-related illness is adequate fluid intake. Workers should drink 1/2 to 1 quarts of liquids per hour in high heat conditions. Most of this liquid should be water. Under heavy work and heat conditions, the body may lose up to 2 gallons of fluids per day. To prevent heat stress symptoms, the individual must ensure replacement of this fluid.
- Provide disposable cups that hold about 4 ounces, and water that is maintained at 50 to 60°F. Workers should drink 16 ounces of water before beginning work, and a cup or two at each break period.
- Provide a shaded area for rest breaks. Ensure that adequate shelter is available to protect personnel against heat and direct sunlight. When possible, shade the work area.
- Discourage the intake of caffeinated drinks during working hours.
- Monitor for signs of heat stress.
- Encourage workers to maintain a good diet during these periods. In most cases, a balanced diet and lightly salted foods should help maintain the body's electrolyte balance. Bananas are especially good for maintaining the body's potassium level.
- If utilizing commercial electrolyte mixes, double the amount of water called for in the package directions. Indications are that "full-strength" preparations taken under high heat stress conditions may actually decrease the body's electrolytes.
- Acclimate workers to site work conditions by slowly increasing workloads (i.e., do not begin work activities with extremely demanding tasks).
- Rotate shifts of workers who are required to wear impervious clothing in hot weather.
- Encourage workers to wear lightweight, light-colored, loose-fitting clothing.
- In extremely hot weather, conduct field activities in the early morning and evening.
- Provide cooling devices to aid natural body heat regulation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear, which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Good hygienic standards must be maintained by frequent showering and changes of clothing.
- Clothing should be permitted to dry during rest periods.
- Whenever working in the sun, provide employees with sunscreen with both UVA and UVB protection.
- Persons who notice skin problems should immediately consult medical personnel.

## Heat Stress Monitoring and Work Cycle Management

When strenuous field activities are part of on-going site work conducted in hot weather, the following guidelines should be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures should be instituted when the temperature exceeds 70°F and the tasks/risk analysis indicates an increased risk of heat stress problems. Consult the HASP and a safety professional (e.g., Division EHS Manager, FSO) if questions arise as to the need for specific heat stress monitoring. In all cases, the site personnel must be aware of the signs and symptoms of heat stress and provide adequate rest breaks and proper aid as necessary.

Measure Heart Rate – Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the rest period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats per minute.

Measure Body Temperature – When ambient temperatures are over 90°F, body temperatures should be measured with a clinical thermometer as early as possible in the rest period. If the oral temperature exceeds 99.6°F (or 1 degree change from baseline) at the beginning of the rest period, the following work cycle should be shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F (or 1 degree change from baseline). Under no circumstances should a worker be allowed to work if their oral temperature exceeds 100.6°F.

Measure Body Water Loss – Body water loss greater than 1.5% of total body weight is indicative of a heat stress condition. Body weight is measured before PPE is donned and after the PPE is removed following a work cycle. Body water loss can be measured with an ordinary bathroom scale; however, the scale must be sensitive to one-half pounds increments. A worker is required to drink additional fluids and rest if their body water loss is greater than 1.5%.

**NOTE:** For purposes of this operating practice, a break is defined as a 15-minute period and/or until an individual's vital signs are within prescribed guidelines.

A physiological monitoring schedule is determined by following the steps below:

- Measure the air temperature with a standard thermometer.
- Estimate the fraction of sunshine by judging what percent the sun is out (refer to Table 1).
- Calculate the adjusted temperature based on the following formula:  
$$\text{Adjusted Temperature} = \text{Actual Temperature} + 13 \times X \text{ (where } X = \text{sunshine fraction from Table 1)}$$
- Using Table 2, determine the physiological monitoring schedule for fit and acclimated workers for the calculated adjusted temperature.

The length of work period is governed by frequency of physiological monitoring (Table 2). The length of the rest period is governed by physiological parameters (heart rate and oral temperature).

**Table 1. Percent Sunshine Factors  
Heat Stress Prevention and Monitoring**

<b>Percent Sunshine (%)</b>	<b>Cloud Cover</b>	<b>Sunshine fraction</b>
100	No cloud cover	1.0
50	50% cloud cover	0.5
0	Full cloud cover	0.0

**Table 2. Physiological Monitoring Schedule  
Heat Stress Prevention and Monitoring**

<b>Adjusted Temperature</b>	<b>Level D (Permeable clothing)</b>	<b>Level C, B, or A (Nonpermeable clothing)</b>
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (28.1° - 32.2°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

**Example:** Site personnel anticipate wearing level C (impermeable clothing) during site activities. The air temperature is 80°F and there are no clouds in the sky (100% sunshine). The adjusted temperature is calculated in the following manner:

$$\begin{aligned}\text{Adjusted Temperature (Adj T } ^\circ\text{F)} &= \text{Actual Temperature (Amb T } ^\circ\text{F)} + (13 \times \text{sunshine fraction}) \\ \text{Adj T } ^\circ\text{F} &= 80^\circ\text{F} + (13 \times 1.0) \\ \text{Adj T } ^\circ\text{F} &= 93^\circ\text{F}\end{aligned}$$

Using Table 2, the pulse rate, oral temperature and body water loss monitoring would be conducted after each 15 minutes of work. The adjusted temperature may need to be redetermined if the percent sunshine and ambient temperature changes drastically during site work.

If an individual's heart rate exceeds 110 beats per minute at the beginning of the rest period, that individual will continue to rest until his or her heart rate drops to baseline; the next work period is then decreased by 33%.

## FLD 06 COLD STRESS

Three major factors that contribute to cold stress are cold temperatures, dampness, and wind velocity. Persons working outdoors in low temperatures, especially in wet or windy conditions, are subject to cold stress. Exposure to extreme cold for even a short time can cause severe injury to the surface of the body, or result in cooling of the body core temperature which, if unchecked, can be fatal. Site workers must learn to recognize and treat the various forms of cold stress.

### RELATED FLDs

*FLD 02 – Inclement Weather*

*FLD 17 – Diving*

*FLD 19 – Working Over or Near Water*

*FLD 25 – Working at Elevation/Fall Protection*

### GENERAL INFORMATION

Body heat is conserved through the constriction of surface blood vessels. This constriction reduces circulation at the skin layers and keeps blood nearer the body core. Loss of body heat can occur through:

1. Respiration – The process of breathing; inhaling and exhaling air. Heat is lost when breathing cold air into the lungs.
2. Evaporation – Heat loss from the body by vaporization of water from the skin surface.
3. Conduction – Direct transfer of body heat by contact with a cooler object. Conduction may occur when sitting on snow, touching cold equipment, and working in the rain. Body heat is lost rapidly when a person becomes wet. Most clothing loses approximately 90 percent of its insulating properties when wet. Additionally, water conducts heat 240 times faster than air; thus, the body cools suddenly when the layer of clothing that contacts the skin becomes wet.
4. Radiation – Heat radiated outward from the body to a cooler environment. The greatest amount of body heat is lost from uncovered surfaces of the body, especially the head, neck, and hands.
5. Convection – Heat transferred to cool air moving across the surface of the body. The body continually heats a thin layer of air next to the skin. Clothing retains this warm surface layer of air. If this warm air is removed by air currents (wind), the body will be cooled while attempting to rewarm the surface air. Wind chill is the chilling effect of moving air in combination with low temperature.

Other factors may contribute to cold stress, such as:

1. Medications, including antidepressants, sedatives, tranquilizers and some heart medications may affect the body's ability to thermo-regulate.
2. Dehydration, or the loss of body fluids, occurs in a cold environment and may increase the susceptibility of workers to cold injury due to a significant change in blood flow to the extremities.
3. Heavy work typically causes sweating that will result in wet clothing.

4. A worker's predisposing health condition such as cardiovascular disease, diabetes, and hypertension.
5. Older people are not able to generate heat as quickly, thus may be at more risk than younger adults.

When the body is unable to warm itself, serious cold-related illness and injuries may occur, including permanent tissue damage and possible death.

## **RECOGNITION AND RISK ASSESSMENT**

In the planning stages of a project, the potential for cold-related hazards must be considered in the site-specific Health and Safety Plan (HASP) and during risk assessment. The Field Safety Officer (FSO) must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or the risk is too great.

### **Low Temperature + Wind Speed + Wetness = Injuries and Illness**

The Cold Stress Equation (OSHA Card-3156) is a quick-reference tool provided on the Weston Portal.

## **Frostbite**

Frostbite is the freezing of tissue and most commonly affects the toes, ears, fingers, and face. Frostbite occurs when an extremity loses heat faster than it can be replaced by the circulating blood. Frostbite may result from direct exposure to extreme cold or cool, high wind. Damp socks and shoes may contribute to frostbite of the toes.

Signs and symptoms of frostbite include:

- Cold, tingling, aching, or stinging feeling followed by numbness
- Skin color is red, purple, white, or very pale and is cold to the touch
- Blisters may be present (in severe cases)

Treatment for frostbite:

- Call for emergency medical assistance.
- Move the victim indoors and/or away from additional exposure to cold, wet, and wind.
- Wrap the affected area in a soft, clean cloth (sterile, if available).
- Give a warm drink (water or juices, not coffee, tea or alcohol). Do not allow the victim to smoke.
- Do not rub the frostbitten part (this may cause gangrene).
- Do not use ice, snow, gasoline or anything cold on the frostbitten area.
- Do not use heat lamps or hot water bottles to rewarm the frostbitten area.
- Do not place the frostbitten area near a hot stove.
- Do not break blisters.
- After rewarming, elevate the area and protect it from further injury.

## **Hypothermia**

Hypothermia means “low heat” and is a potentially serious condition. Systemic hypothermia occurs when body heat loss exceeds body heat gain and the body core temperature falls below the normal 98.6°F. While some hypothermia cases are caused by extremely cold temperatures, most cases develop in air

temperatures between 30° and 50°F, especially when compounded with water immersion and/or windy conditions.

The victim of hypothermia may not know, or refuse to admit, that he or she is experiencing hypothermia. All personnel must be observant for these signs for themselves and for other team members. Hypothermia can include one or more of the following symptoms.

- Cool bluish skin
- Uncontrollable shivering
- Vague, slow, slurred speech
- Irritable, irrational, or confused behavior
- Memory lapses
- Clumsy movements, fumbling hands
- Fatigue or drowsiness

Below the critical body core temperature of 95°F, the body cannot produce enough heat by itself to recover. At this point, emergency measures must be taken to reverse the drop in core temperature. The victim may slip into unconsciousness and can die in less than 2 hours after the first signs of hypothermia are detected. Treatment and medical assistance are critical.

Treatment for hypothermia:

- Call for emergency medical assistance.
- Do not leave the victim alone.
- Prevent further heat loss by moving the person to a warmer location out of the wind, wet, and cold.
- Remove cold, wet clothing and replace with warm dry clothing or wrap the victim in blankets.
- If the victim is conscious, provide warm liquids, candy, or sweetened foods. Carbohydrates are the food most quickly transformed into heat and energy. Do not give the victim alcohol or caffeine.
- Have the person move their arms and legs to create muscle heat. If they are unable to move, place warm bottles or hot packs in the arm pits, groin, neck, and head. Do not rub the arms and legs or place the person in warm water.

## **Prevention and Protection**

The following general guidelines are recommended for preventing or minimizing cold stress:

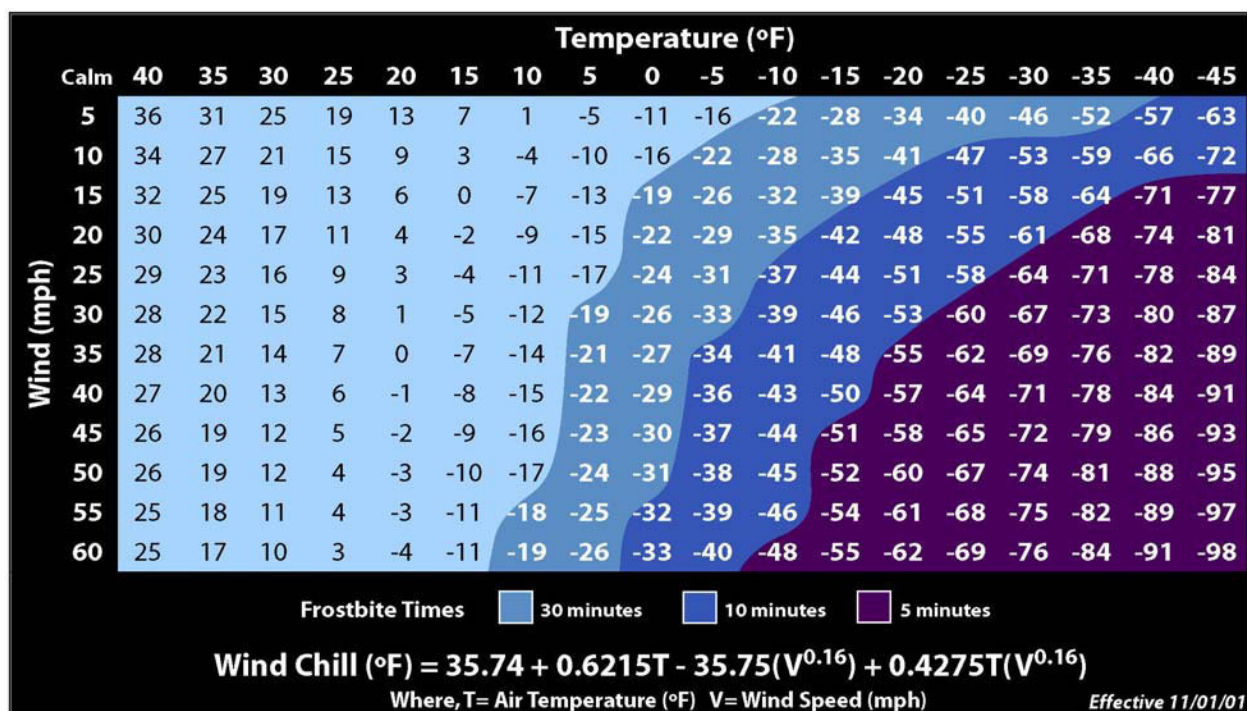
- Wear loose, layered clothing, masks, woolen scarves, and hats. Wear liners under hard hats
- Protect hands with gloves or mittens.
- Never touch cold metal with bare hands.
- Wear waterproof, slip-resistant, insulated boots
- Use chemical foot and hand warmers (commercially available) inside boots and gloves.
- In extreme cold, cover the mouth and nose with wool or fur to “pre-warm” the air you breathe.
- If wearing a face protector, remove it periodically to check for frostbite.

- Ensure that clothing remains secure around the body, especially at the neck and waist.
- If required to wear chemical protective clothing, remember that it generally does not afford protection against cold stress. In many instances, chemical protective clothing increases susceptibility. Dress carefully if both chemical protection and thermal insulation are required.
- Remove outer layers to avoid overheating and soaking clothing with perspiration; replace layers to avoid becoming chilled.
- Keep clothes dry by wearing water-resistant and wind-resistant clothing and outerwear.
- Wear clothing that will “breathe” or allow water vapor to escape.
- Eat well-balanced meals, ensure adequate intake of liquids and avoid alcoholic beverages. Drink warm sweet beverages and soups. Limit the intake of caffeinated drinks due to the diuretic and circulatory effects.
- Utilize available warm shelters and implement work-rest schedules.
- If warm shelters are not available, use cars/vehicles as shelter from the cold. (Ensure that tailpipes are not covered by heavy snowfall).
- Use radiant heaters to provide warmth (if using propane heaters ensure adequate ventilation to avoid carbon monoxide poisoning).
- Monitor yourself and others for changes in physical and mental condition.
- Use the buddy system or supervision to ensure constant protective observation.
- If heavy work must be done, resulting in sweating/wet clothing, take rest periods in heated shelters and change into dry clothing as necessary.
- New employees should not work full-time in the cold during the first days of employment until they become accustomed to the working conditions and the use of required protective clothing.
- Include the weight and bulkiness of clothing in estimating the required work performance and weights to be lifted by the worker.
- Arrange the work in such a way that sitting or standing still for long periods is minimized.
- Perform work protected from drafts to the greatest extent possible. If possible, shield the work area from wind.
- Instruct workers in safety and health procedures. The training program should include, as a minimum, instruction in:
  - Signs and symptoms of frostbite, impending hypothermia, or excessive cooling of the body
  - Proper use of clothing
  - Proper eating and drinking habits
  - Safe work practices
  - Proper rewarming procedures and appropriate first aid treatment
- Tables 1 and 2 should be consulted to adjust working schedules for wind chill conditions based on equivalent chill temperature (ECT). These tables are guidelines only; ambient temperatures and wind conditions should be monitored frequently and work schedules adjusted as required. If workers show signs or symptoms of cold stress, the work schedule must be adjusted, as required.

## Work/Warming Regimen

Work should be performed in the warmest part of the day. If work is performed continuously in the cold or winter conditions or where rain or cool winds are expected, provide heated warming shelters, tents, cabins, or break rooms nearby. Encourage workers to use the shelter at regular intervals depending on the severity of the cold exposure. Table 2, Cold Work/Warmup Schedule for 4-Hour Shifts, provides guidance for working in severe cold weather. The onset of heavy shivering, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter. Pain, numbness, or tingling in the extremities are indications for immediate return to the shelter. When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation, or the worker should change into dry clothing. Never return to work in wet clothing.

**Table 1. Wind Chill Chart**



NWS/NOAA

**Table 2. Cold Work/Warmup Schedule for 4-Hour Shifts**

EQUIVALENT CHILL TEMPERATURE	MAXIMUM WORK PERIOD	NO. OF BREAKS
≥-24°F	Normal	1
-25° to -30°F	75 minutes	2
-31° to -35°F	55 minutes	3
-36° to -40°F	40 minutes	4
-41° to -45°F	30 minutes	5
≤-46°F	Stop work	Stop work

## **FLD 11 ROUGH TERRAIN/ATV USE**

### **RELATED FLDs**

*FLD 02 – Inclement Weather*

*FLD 05 – Heat Stress Prevention and Monitoring*

*FLD 06 – Cold Stress*

*FLD 22 – Heavy Equipment Operation*

*FLD 47 – Clearing, Grubbing, and Logging Operations*

*FLD 57 – Motor Vehicle Safety*

### **HAZARD**

Physical hazards associated with rough terrain include vehicle accidents, heavy equipment incidents, falling, slipping, and tripping.

Driving vehicles on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles and other vehicles.

When working on foot, steep inclines and heavy or downed vegetation can hide holes or breaks in the terrain, increasing the risk of slips, trips, and falls.

### **RECOGNITION AND RISK ASSESSMENT**

Rough terrain complicates work activities and adds to or increases risk. In the planning stages of a project, rough terrain must be considered as a physical hazard and identified in the site-specific health and safety plan (HASP). Risk assessment is usually accomplished from site history information (i.e., site topography) and on site by the Field Safety Officer (FSO).

### **HAZARD PREVENTION AND PROTECTION PROGRAMS**

#### **Safety on Foot**

Personnel working on rough terrain should maintain a high level of physical conditioning due to increased body stress and exertion.

The site crew should be alert and observe terrain while walking to minimize slips, trips, and falls.

Boots should be ankle high or higher to provide additional support and stability.

Work will be completed in adequate natural light or sufficient illumination will be maintained.

Site personnel will conduct an initial walkover and the “buddy system” will be implemented.

Emergency communications such as a cell phone or two-way radio should be carried at all times.

Personnel should be aware of potential hazards and ensure the availability of first-aid supplies and knowledge of the location of the nearest medical assistance.

#### **VEHICLE SAFETY**

Vehicle drivers and passengers will wear seatbelts at all times.

Hazards can be prevented by ensuring regular maintenance is performed on vehicles and all safety features are working. Have brakes and wheel bearings of vehicles used off road or in four wheel drive inspected at increased frequency (suggest inspections at twice the manufacturer's recommended frequency).

In order to minimize accidents, site surveillance on foot may be required to ensure clear driving paths.

Minimize side hill travel. Travel straight up and down hills whenever possible. Passengers will not be allowed when side hill travel is required.

Take into account loads or superstructure of vehicles which raise the center of gravity and increase risk of tipping.

Cross streams, small logs or other passable (there is adequate clearance of the undercarriage) obstructions at right angles.

Four wheel drive vehicles should be used if terrain conditions are wet, frozen, broken, or otherwise deemed unsafe for two wheel drive vehicles by the FSO. Use of vehicles off-road will be specifically addressed in the HASP and personnel operating vehicles will be checked for proficiency.

- Before moving a vehicle in the field, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Always check the brakes of a vehicle before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Engage the all wheel drive when traveling off highway on hilly terrain.
- Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the vehicle/equipment has been moved to a new site, set all brakes and/or locks. When grades are steep, block the wheels.

## **Definitions**

**Class I, All-terrain vehicle (ATV):** A motorized off-highway vehicle, 50 in. (127 cm) or less in width, having dry weight of 800 lbs (362.9 kg) or less, and traveling on three or more low pressure tires (10 lbs [4.5 kg] psi or less), with a seat designed to be straddled by the operator.

**Class I, Category G, ATV:** An ATV intended for general recreational and utility use.

**Class I, Category U, ATV:** An ATV intended primarily for utility use.

**Class II, ATV:** A motorized off-highway vehicle with a width which exceeds 50 in. (127 cm) or having a dry weight that exceeds 800 lbs (362.9 kg), traveling on four or more low-profile, low-pressure tires (10 lbs [4.5 kg] psi or less) and having a bench seat.

**NOTE:** Utility Vehicles are designed to perform off-road utility tasks such as passenger and cargo transportation and are addressed separately below. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Rollover Protective Structure (ROPS). A cab or frame that provides a safe environment for the tractor operator in the event of a rollover.

## **ALL TERRAIN VEHICLES (ATVS)**

### **Qualifications**

ATV operators will have completed a nationally recognized accredited ATV training course (such as provided by the Specialty Vehicles Institute of America or in-house resources that have been certified as trainers by an accredited organization) prior to operation of the vehicle.

The operator must pass an operating skills test prior to being allowed to operate an ATV. Proof of completion of this training will be maintained.

### **Equipment**

All ATVs shall be equipped with:

- An operable audible warning device (horn);
- Headlights (if it will be used during hours of darkness);
- Taillights; and
- Brake lights.
- Mufflers and spark arresters.

All Class II ATVs will be equipped with ROPS and seatbelts

### **Operation**

Only Class I and Class II ATVs with four or more wheels may be used. Class III ATV's may not be used.

The manufacturer's recommended payload will not be exceeded at any time.

Gloves and an approved motorcycle helmet with full-face shield or goggles will be worn at all times while operating a Class I ATV.

An ATV will not be driven on public roadways except to cross the roadway, and it will only be driven on a public roadway at designated crossing points or with a road guard (no paved road use unless allowed by the manufacturer).

A copy of the operator's manual will be kept on the vehicle and protected from the elements (if practicable).

Tires shall be inflated to the pressures recommended by the manufacturer.

Passengers are prohibited on Class I ATVs.

## UTILITY VEHICLES

Utility vehicles are defined as specialty Class II ATVs designed to perform off-road utility tasks such as passenger and cargo transportation. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Utility vehicle operators shall be trained and familiar with the use of all controls; understand proper moving, stopping, turning and other operating characteristics of the vehicle. Operators must review all training materials provided by the manufacturer for the specific vehicles, and training should be in accordance with appropriate manufacturer recommendations. A copy of the operator's manual shall be kept on the vehicle at all times and protected from the elements. At a minimum, training should address:

- Basic riding tips from the manufacturer's published literature for each vehicle.
- Reading terrain.
- Climbing hilly terrain.
- Descending a hill.
- Traversing a slope.
- Riding through water.
- Cargo carriers and accessories.
- Loading and unloading.
- Troubleshooting.
- Proper preventative maintenance, (i.e., oil levels, tire pressure requirements and scheduled maintenance requirements according to the manufacturer's guidelines.).

Utility vehicles shall be equipped with:

- Operable audible warning device (horn).
- Headlights.
- Taillights.
- Brake lights.
- Seatbelts.
- ROPS.

Occupancy in utility vehicles is limited to manufacturer designated seating that has built-in seatbelts. Passengers may not ride in the vehicle's back cargo area unless the vehicle is otherwise equipped. Note: When used for emergency response, medical litters may be placed in the back cargo area but must be secured as described below.

The manufacturer's recommended load carrying capacity, personnel capacity, or maximum safe vehicle speed shall not be exceeded at any time.

Cargo items will be secured as necessary to prevent movement/tipping. All loads over fifty pounds (to include medical litters) must be securely strapped to cargo tie-downs in the rear and to the cargo shelf in the front.

Seatbelts will be worn by operators and passengers of specialty vehicles where installed by the manufacturer. Operators and passengers shall wear goggles at all times when a utility vehicle, not equipped with a windshield, is in motion.

Utility vehicles will not normally be driven on public roadways except to cross the roadway, and will only be driven on a public roadway at designated crossing points or with a road guard. Utility vehicles that are allowed to operate outside a controlled work area and/or on public roads will meet the minimum vehicle safety standards in accordance with 49 CFR 571.5, to include ROPs, seatbelts and placement of “Slow Moving Vehicle” emblems where required.

Manufacturer-installed safety equipment will be maintained in working order and used in compliance with the requirement of this regulation and in accordance with manufacturer’s recommendations.

## **RULES**

Observe the following practices to help prevent accidents:

- Do not misuse utility vehicles.
- Reduce speed and exercise extreme caution on slopes or on rough ground.
- Do not overload vehicle and avoid shifting loads. Reduce load when operating over rough or hilly terrain.
- Do not stop or start suddenly when going uphill or downhill. Be especially cautious when changing direction on slopes.
- Stay alert for holes, rocks, and other hidden hazards in the terrain.
- Keep away from drop-offs, ditches, embankments, as well as ponds and other bodies of water. The machine could suddenly turn over if a wheel is over the edge of a cliff or ditch, or if an edge caves in.
- Keep front wheels straight at crest of hill or going over bumps.
- When descending a hill, remove foot from accelerator and apply brakes to reduce speed and maintain control.

## **Transport Loads Safely**

- Be sure load is evenly distributed.
- Do not load above the load guard.
- Securely anchor all loads in cargo box.
- Reduce cargo box capacity when operating on rough or hilly terrain.
- Use existing trails. Avoid terrain such as dangerous slopes and impassable swamps. Watch carefully for sharp bumps, holes, ruts, or obstacles.
- Look ahead at terrain. Know what is coming and be prepared to react. Be alert for hazards.
- Keep front wheels straight at the crest of a hill or going over bumps.
- Reduce speed according to trail, terrain, and visibility conditions.
- The passenger should always use the hand holds.

### **Climbing or Descending a Hill**

- Always use the brakes when going down slopes, the utility vehicle can speed up (freewheel) going down a slope. Engine or clutch braking effect is minimal.
- Balance loads evenly and secure them. Braking could shift the load and affect vehicle stability.
- Sit on the center of the seat and keep both feet within the foot platform.
- Never drive past the limit of visibility. Slow down near the crest of a hill until getting a clear view of the other side.
- If the vehicle stops or loses power going up a hill, lock the park brake to hold the vehicle on slope. Maintain direction of travel and release the brake slowly. Back straight down hill slowly while maintaining control. Do not turn the vehicle sideways. The vehicle is more stable in a straight forward or rearward position.
- If the utility vehicle begins to tip, turn the front wheel downhill to gain control before proceeding.

### **Riding Through Water**

- Avoid water whenever possible. If the drive belt becomes wet, slippage will occur and the vehicle will lose power.
- Never cross any body of water where the depth may be unknown to the operator. As an operational guideline, deep water is considered anything in excess of 152 mm (6 in.) in depth. Tires may float, making it difficult to maintain control.
- Choose a course within the waterway where both banks have a gradual incline. Cross at a point known to be safe.
- Proceed at a slow steady speed to avoid submerged obstacles and slippery rocks.
- Avoid water crossings where the operation of a utility vehicle may cause damage to waterway beds or erode waterway shoreline.

## **FLD 22 EARTH MOVING EQUIPMENT/MATERIAL HANDLING EQUIPMENT**

### **REFERENCES**

*29 CFR Part 1926 Subparts 600-602*

### **RELATED FLDs**

*FLD 23 – Cranes, Rigging, and Slings*

*FLD 24 – Aerial Lifts/Manlifts*

*FLD 34 – Utilities*

*FLD 35 – Electrical Safety*

### **PROCEDURE**

These rules apply to the following types of earthmoving equipment: scrapers, loaders, crawler or wheel tractors, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

#### **Machinery and Mechanized Equipment Safety**

Before any machinery or mechanized equipment is placed in use, it will be inspected and tested by a competent mechanic and certified to be in safe operating condition.

WESTON will designate a competent person to be responsible for the inspection of all machinery and equipment daily and during use to make sure it is in safe operating condition. Tests will be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

Preventative maintenance procedures recommended by the manufacturer will be followed.

Any machinery or equipment found to be unsafe shall be removed from service and its use prohibited until unsafe conditions have been repaired or corrected.

Inspections or determinations of road conditions and structures will be made in advance to ensure that clearances and load capacities are safe for the passing or placement of any machinery or equipment.

Machinery and mechanized equipment will be operated only by designated personnel. Equipment deficiencies observed at any time that affect safe operation will be corrected before continuing operation.

Seat belts shall be provided on all equipment covered by this section and shall meet the requirements of the Society of Automotive Engineers (J386-1969) and Seat Belts for Construction Equipment. Seat belts for agricultural and light industrial tractors shall meet the seat belt requirements of Society of Automotive Engineers (J333a-1970), Operator Protection for Agricultural and Light Industrial Tractors.

Seat belts shall be worn when provided by the manufacturer. Passengers shall not be allowed to ride on equipment unless equipment is designed with additional seats with safety belts.

**Audible alarms.** All bi-directional machines, such as rollers, compacters, front-end loaders, bulldozers, and similar equipment, shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. The horn shall be maintained in an operative condition.

Getting off or on any equipment while it is in motion is prohibited.

Machinery or equipment requiring an operator will not be permitted to run unattended.

Machinery or equipment will not be operated in a manner that will endanger persons or property, nor will the safe operating speeds or loads be exceeded.

All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. The only exemption is equipment designed to be serviced or maintained while running.

All repairs on machinery or equipment will be made at a location that will provide protection from traffic or other hazards to maintenance personnel.

Machinery and equipment, or parts thereof, that are suspended or held apart by slings, hoists, or jacks also will be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

Bulldozer and scraper blades, front end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

Stationary machinery and equipment will be placed on a firm foundation and secured before being operated.

All points requiring lubrication during operation will have fittings so located or guarded to be accessible without hazardous exposure.

When necessary, all mobile equipment and the operating area will be adequately illuminated while work is in progress.

Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shutoff that will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.

All towing devices used on any combinations of equipment will be securely mounted and structurally adequate for the weight drawn.

Persons will not be permitted to get between a piece of towing equipment and the item being towed until the towing equipment has come to a complete stop.

All equipment with windshields will be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields will be equipped with operable defogging or defrosting devices.

All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, will have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

Whenever the equipment is parked, the parking brake will be set. Equipment parked on inclines will have the wheels chocked or track mechanism blocked and the parking brake set. Equipment such as lift trucks and stackers will have the rated capacity posted on the vehicle so as to be clearly visible to the operator. When auxiliary removable counterweights are provided by the manufacturer, corresponding alternate rated capacities also will be clearly shown on the vehicle. The ratings will not be exceeded.

Steering or spinner knobs will not be attached to the steering wheel unless the steering mechanism prevents road reactions from causing the steering hand wheel to spin. When permitted, the steering knob will be mounted within the periphery of the wheel.

All industrial trucks in use will meet the requirements of design, construction, stability, inspection, testing, maintenance, and operation, defined in American National Standards Institute (ANSI) B56.1, Safety Standards for Powered Industrial Trucks.

The installation of live booms on material and personnel hoists is prohibited.

The controls of loaders, excavators, or similar equipment with folding booms or lift arms will not be operated from a ground position unless so designed.

Personnel will not work or pass under the buckets or booms of loaders in operation.

Cranes and any other equipment used for lifting must be inspected as required and records of inspection must be maintained.

### **Drill Rigs**

See FLD 56, *Drilling Safety*

## **FLD 28 EXCAVATING/TRENCHING**

This procedure identifies the basic requirements for the protection of personnel working in and around excavations and trenches, including identification of hazards, classification of soils, protective systems, and inspections. Trenching and excavation work will be done in conformance with this procedure, and with 29 Code of Federal Regulations (CFR), 1926 Subpart P (Excavations) as well as any state, local, and client requirements.

### **REFERENCES**

29 CFR 1926 Subpart P (Excavations)

### **ATTACHMENTS**

Attachment 1 – Inspection-Permit Checklist

Attachment 2 – Audit Checklist

### **RESPONSIBILITIES**

The responsibilities of the personnel involved in any trenching and excavation work are:

- Project Manager (PM)/Site Manager (SM): In addition to their normal safety responsibilities as described in the Safety Program Implementation Plan, the PM or SM will be responsible for identifying and checking the qualifications of the competent persons whom they designate for excavation or trenching activities at their project site.

Competent Person: For the purpose of this procedure, the competent person is one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous or dangerous to employees and who has authorization to take prompt corrective actions to eliminate them. The competent person in excavations must have knowledge of regulatory requirements and the necessary technical skills (e.g., soils classification, use of protective systems) to implement this operating practice and address any necessary client concerns or requirements. The competent person must be a Registered Professional Engineer (PE) with experience in soil classification and stability analysis for excavations in excess of 20 feet in depth, excavations that intersect, excavations close enough to buildings, or other surface appurtenances that they could exert stress on the excavation side walls.

The competent person may be the Field Safety Officer (FSO), a subcontractor representative or other site person. The competent person must be identified in writing and understand the role and responsibilities of the competent person.

### **Hazard Assessment and Evaluation**

Prior to any excavation activity the FSO and the competent person must evaluate the site for known or potential hazards. Potential hazards affecting trench safety can include the following:

- Excess water from rainfall, snowmelt or frozen soils, and temperature extremes affecting soil moisture content.
- Previous excavation area (requires Type C soils classification).
- Depth of excavation (influences soil stability by increased weight; average soils weigh approximately 100 pounds per cubic foot).

- Surcharge loads (e.g., evaluate location of buildings, spoils piles, poles, pavement, other structural objects).
- Location of personnel and equipment.
- Vibration by equipment, traffic, railroads, explosives, etc.
- Undermining of structures.
- Duration of exposure (limit the time-frame of the excavation to the minimum possible).

Prior to excavation or trenching, utility companies or owners shall be contacted and requested to identify the exact location of installations in the area. WESTON FLD 34, "Utilities" must be followed. If the companies or owners do not respond within 24 hours or the period established by law or ordinance, or if they cannot establish the exact location of underground installations, WESTON or a subcontractor may proceed with the excavation following WESTON FLD 34 to determine other acceptable means to locate utility installations. The known or estimated location of utilities must be marked or staked for identification purposes. Workers and equipment operators must also be aware of overhead utilities.

When excavation operations approach the estimated location of underground installations, the exact location is to be determined by safe and acceptable means.

The stability of adjacent structures is to be assured in any event (whether employees will enter an excavation or not).

All surface encumbrances that are located to create a hazard to employees shall be removed or supported, as necessary. Structures near the excavation shall be underpinned or provided with a support system to prevent collapse.

If the excavation is in an area known or suspected to be contaminated with unexploded munitions or military ordnance, clearance by qualified explosive ordnance disposal (EOD) personnel shall be accomplished prior to excavation work. Work will be performed in accordance with an approved unexploded ordnance (UXO) plan.

### **Pre-Entry Requirements**

While not required as documentation by Occupational Safety and Health Administration (OSHA) regulations (with the exception the utility clearances noted above and in certain states, e.g., California where a permit is required from the State for certain excavations), the Excavation Inspection-Permit (Attachment 1) should be utilized as a guideline in preparation for excavation activities. This checklist or similar approved form, subcontractor form, or site-specific form shall be completed by the competent person prior to the start of operations each day and as needed throughout the shift (See Inspections and Enforcement Section) to document required inspections. The SM shall ensure that monitoring and inspections are performed periodically to verify compliance. Note that clients, in particular Department of Defense (DoD) may require dig or excavation permits as well. These must be in-hand and posted if required before excavation begins and must be renewed as specified by the client.

The competent person shall classify the type of soil using at least one visual and one manual test in accordance with 29 CFR 1926 Subpart P, Appendix A or assume all soils are class C and stipulate appropriate protection methods as for Class C soil. Where tests are performed, the tests shall be documented, including the date(s) of the tests, type of tests, any instrumentation used for testing, location of the excavation tested, the results of the tests and type of soil (A, B, C, or stable rock) indicated by the

test, and the name of the person performing the tests or the report must state that soils will be treated as Class C soils.

The competent person must test the atmosphere in any excavation greater than 4 feet in depth where the potential exists for a known or potential hazardous atmosphere (e.g., landfills, spills before employees are allowed to enter the excavation). Emergency rescue equipment shall be provided and readily available, properly functioning, and attended by qualified personnel when hazardous atmospheric conditions exist or may develop. Based upon the direction of the competent person or the FSO an excavation less than 4 feet deep may require monitoring.

## **Entry Procedures**

While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard employees.

A barricade or other suitable warning system shall be used to alert workers, equipment, and vehicle operators of an excavation's location if the edge of the excavation is not readily apparent. Consult Corps of Engineers EM 385-1-1, (current edition), Section 25 for special requirements related to excavation guarding requirements. If the edge of an excavation is adjacent to a public roadway or an area of high volume site traffic it shall have a suitable barricade, such as a 2- to 3-foot (ft) high berm or jersey barriers, installed along the exposed side of the route. Appropriate barricades shall not interfere with placing overburden a safe distance from the excavation, but they shall have sufficient strength to prevent vehicles from entering the excavation.

Excavations located in areas subject to public traffic must be protected by fencing or barricades constructed with equivalent strength to standard guardrails. The location of fencing or guardrails must be such that risk to the public is minimal.

If the excavation is not subject to public exposure, but is routinely exposed to employees and is either 1) deeper than 6 feet or 2) contains hazards (e.g., impalement, hazardous substances) then perimeter protection is to consist of warning barricades or flagging placed no closer than 6 feet from the excavation edge. Warning barricades or flagging should be between 3 and 4 feet in height.

If the excavation edge is not readily visible and does not meet any of the criteria identified above, perimeter protection of warning flags or barricades (see above) located between 2 and 6 feet from the excavation edge is required.

Working at the edge of the excavation must be minimized. Based upon the hazard evaluation, fall protection in the form of harnesses and lifelines, may be required if workers must observe activities at the edge of an excavation greater than 6 feet deep.

Lighting for excavations and barricades during nighttime or low visibility situations must be in accordance with state or local requirements.

All shafts, pits, wells, etc., where no work is being performed shall be covered with material of sufficient strength to support foreseeable loads, or shall have a standard guardrail or equivalent protection installed around the perimeter, or shall be backfilled.

Walkways and bridges with standard guardrail systems shall be provided where people or equipment are required or permitted to cross over excavations.

Employees in excavations or trenches shall not be permitted to work in the immediate vicinity of excavation equipment nor to work under loads handled by such equipment. Employees shall not be allowed to work above other employees in the excavation unless the employees working below are adequately protected.

Employees shall not be allowed to work in excavations where water has accumulated or is accumulating unless diversion ditches, dikes, or other means shall be used to prevent surface water from entering an excavation and to provide drainage to the adjacent area. Pumps, if used to control water accumulation, must be monitored continuously.

Only authorized personnel are allowed within excavations. The number of workers within an excavation must be maintained to the minimum necessary to accomplish the assigned work.

A ladder, stairway, ramp or other means of exiting excavations 4-feet deep or more will be provided for employees within 25 feet of lateral travel of any location within the excavations. Ramps used for employee access or egress must be sloped to allow the employee to walk in an upright manner without assistance. Ramps for equipment access or egress must be designed by a registered PE.

Spoils and other materials are to be placed at sufficient distance from the edge of the excavation to prevent excessive loading on the face of the excavation. In no event is any material to be placed closer than 2 feet from the edge.

Personnel will be evacuated from any excavation when the walls show signs of distress and personnel are potentially impacted.

### **Protective Support Systems**

Employees in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with the following. Exceptions to the requirement for employee protective systems include; excavations entirely in stable rock and excavations which are less than 5 feet deep and examination by the competent person provides no indication of a potential cave-in. Protective system options include:

- Proper sloping or benching of the sides of the excavation (benching is not permitted for Class C soils). Follow specific requirements of 29 CFR 1926 Subpart P, specifically 1926.652.
- Supporting the sides of the excavation with a properly designed and installed shoring or shielding system (e.g., hydraulic shoring, trench jacks, air shores, or trench boxes/shields).

Follow specific requirements of 29 CFR 1926 Subpart P, specifically 1926.652. Protective systems outlined within the OSHA standard are minimum requirements. In the event soil conditions change, re-inspect the system. Additional cut backs on the slope angle may be necessary based upon conditions encountered.

Protective systems for use: in excavations greater than 20 feet in depth; where trenches intersect; or where buildings or other surface structures or appurtenances can exert stress on the excavation, walls must be designed by a Registered PE.

### **Inspections and Enforcement**

The competent person must inspect the excavation and the adjacent area frequently for possible cave-ins, for failure of protective systems and equipment, for hazardous atmospheres, or for other hazardous

conditions. Inspections are also required after any occurrence that could increase the potential hazard to employees. The minimal inspection requirement is daily. Competent persons must be on site or immediately available when persons are working in or directly adjacent (within the prescribed safety zone). Natural events, such as rain, freezing or thawing weather, or man-made events, such as blasting and vibration, are examples of situations requiring more frequent inspection.

Daily and as-needed inspections must be documented on applicable portions of the Inspection-Permit (Attachment 1), the Audit Checklist (Attachment 2), or an approved documentation form. The Audit Checklist is designed as a more comprehensive inspection/audit document. All inspections shall be documented.

During inspections, danger signs that should be evaluated can include the following:

- Bulges in the side walls.
- Cracks running parallel to the excavation edge.
- Material sloughing into the excavation.
- Exposed utilities.
- Loose chunks of the excavation edge or lip breaking up.
- Rocks, or refuse from earlier work or any other material that could fall from the excavation walls.
- Undermined structures, poles, or trees.
- Water seepage.
- Spoils piles or other materials too close to the excavation edge.
- Apparent changes in soil classification.

Failure to follow procedures outlined within this FLD will result in documented noncompliance with the requirements of this FLD. Such noncompliance will result in a management-imposed suspension of the activity and may include disciplinary action.

### **Emergency Operations**

The Health and Safety Plan (HASP) must indicate names and phone numbers for any potentially affected utility (e.g., phone, gas, electric, pipelines, public works). The HASP must include a plan for rescuing persons trapped within an excavation.

If a utility is damaged due to the excavation operation, and damage has occurred, operations are to cease. Personnel are to move to a safe location until the hazard has been resolved. The owner of the utility and any other necessary emergency resources are to be contacted immediately.

In the event of a trench failure with subsequent employee entrapment the following procedures should be followed:

- Immediately contact the local rescue agency listed in the HASP. Give the agency the exact location, number of victims, trench measurements, and any special hazards encountered.
- Keep all life-support and de-watering systems operating.
- Clear workers away from the excavation.
- Shut down any heavy equipment nearby.
- Be prepared to meet and brief rescue personnel.
- Never attempt to dig out victims with heavy equipment.

**Records/Reports/Notifications**

The following records shall be maintained in the site files:

- Excavation inspection records.
- Soil classification test records.
- Evaluations of need to stabilize adjacent structures.
- Structural ramp designs.
- Approved tabulated data used for protective systems.
- Protective system designed by a PE

**ATTACHMENT 1**  
**INSPECTION-PERMIT CHECKLIST**

## WESTON EXCAVATION INSPECTION-PERMIT CHECKLIST

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ LOCATION: \_\_\_\_\_

DESCRIPTION OF EXCAVATION: \_\_\_\_\_

PERSON IN CHARGE OF WORK: (SAFETY WATCH, If applicable) \_\_\_\_\_

Item	Y	N	Comment
Is there a competent person on site?			
Have utilities been located?			
Will excavation be less than 5 ft in depth? If yes, has competent person determined appropriate worker protection?			
Will excavation be greater than 5 ft in depth? If yes, complete remainder.			
Will workers in or near top or face of excavation be adequately protected?			
What is expected soil type? _____ Is protection (sloping, benching, shoring, sheeting, or shielding) according to 29 CFR Part 1926.652?			
If sloping/benching used: Angle no greater than 1½ horizontal to 1 vertical (34°)? Conforms to Appendix B, 29 CFR Part 1926.652 for type C soils? Conforms to Appendix A or B? Conforms to other published tables that are onsite? Is designed by competent PE?			
If shoring, sheeting, or shielding is used: Designs based on Appendices A, C, D, or G of 29 CFR Part 1926.652? Designed and used according to manufacturer's specifications and instructions? Design is according to published tables that are onsite? Design is by a competent PE?			
If Appendix A of 29 CFR Part 1926.652 is used, indicate soil classification _____. Is classification based on at least one manual and one visual test?			
Is plan for installation and removal of support systems appropriate?			
Is planned protection for surface encumbrances appropriate?			
Are there adequate provisions for access and egress?			
Is plan for protection from vehicular traffic adequate?			
Are barriers and lighting provided for pedestrian and vehicle protection?			
Is plan adequate for protection from exposure to falling loads?			
Is there an adequate proximity warning system for mobile equipment?			
Does plan adequately address hazards of/protection from accumulating water?			
Does plan adequately take into account stability and potential impact of adjacent structures?			
Is plan for protection from loose soil or rock adequate?			

Item	Y	N	Comment
Inspections will be conducted of excavation and adjacent areas: Prior to start of work? Daily? After rain storms or other hazard increasing occurrences? Are inspections documented?			
Is fall protection adequate?			
Is there a potentially hazardous environment? If yes, complete the following table.			
Is appropriate emergency/rescue equipment available?			

Testing	PEL/Action Level	Concentration/Time			
Percent Oxygen	19.5-23.5%				
Percent LEL	> 20%				
*Carbon monoxide	35 ppm				
*Hydrogen sulfide	10 ppm				

\*If applicable

### ADDITIONAL REQUIREMENTS

Item	Y	N	Comment
Hot work permit required?			
Confined entry procedures and permits required?			
Have all employees reviewed and signed HASP?			

### EMERGENCY PLAN EMERGENCY TELEPHONE NUMBERS:

Fire Department: \_\_\_\_\_ Police Department: \_\_\_\_\_  
Ambulance: \_\_\_\_\_ Medical: \_\_\_\_\_

### EMERGENCY EQUIPMENT

Fire Extinguisher - Type: _____ Location: _____	First Aid Kit - Locations: _____ _____
Rescue Breathing Apparatus - Location: _____ _____	Non-powered digging tools - Location: _____ _____
Life Line Systems - Location: _____ _____	

Field Safety Officer: \_\_\_\_\_ Competent Person: \_\_\_\_\_

Registered Professional Engineer: \_\_\_\_\_

**EMPLOYEES:**

<b>Name (Please Print)</b>	<b>Signature</b>	<b>Duties</b>

**ATTACHMENT 2**  
**AUDIT CHECKLIST**

## WESTON EXCAVATING/TRENCHING AUDIT CHECKLIST

Project: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Inspector: \_\_\_\_\_ Excavation Location: \_\_\_\_\_

Excavation Depth: \_\_\_\_\_ Anticipated Maximum Depth: \_\_\_\_\_

	Y	N	Comment
All excavations inspected?			If no, why not? _____
Soil type verified for each excavation?			Indicate Type: _____
Competent person identified?			Name: _____
PE involved?			Name: _____

**NOTE:** For California operations, a trenching permit issued by the Division of Occupational Safety and Health (DOSH) is required prior to beginning work on any excavation or trench 5 ft deep or deeper in which employees will be required to work.

This inspection list is designed to assist in verifying inspection requirements established in 29 CFR Part 1926.560-562 Subpart P and Cal/OSHA 8 CCR 341, 1540 and 1541.

### A. TRAINING

	Y	N	Comments
1. Have employees been trained in hazard recognition and safe work practices associated with excavation work?			
2. Have employees been trained in excavation emergency procedures?			

### B. SURFACE ENCUMBRANCES (Trees, Boulders, Telephone Poles, Heavy Equipment)

	Y	N	Comments
1. Are all surface encumbrances posing a threat to employees identified, removed, or supported?			

### C. UNDERGROUND UTILITIES/INSTALLATIONS (Electric, Gas, Fuel, Product, Water, Telecommunication, Sewer, Lines, etc.)

	Y	N	Comments
1. Are utility searches completed and documented?			
2. Have the appropriate agencies/client representatives been contacted?			
3. Are local permits obtained and on file?			
4. If excavation will impinge on underground utilities: Are procedures in place to detect/protect as utilities are neared? Are procedures in place to guard/support exposed utility lines?			

#### D. ACCESS AND EGRESS

	Y	N	Comments
1. Are ladders, stairways, or ramps provided every 25 ft of linear travel in excavations 4 ft deep or deeper?			
2. Are ladders appropriately secured and extend at least 3 ft above the top landing area?			
3. Are personnel and equipment access and egress ramps designed by a competent person?			
4. Are ramps/runways of two or more structural members joined so as to prevent displacement?			
5. Are structural members of ramps/runways of two or more members of uniform thickness?			
6. Are the cleats or other appropriate means used to connect runway structural members attached to the bottom of the runway or in a manner to prevent tripping?			
7. Are all structural members slip-resistant?			

#### E. EXPOSURE TO VEHICULAR TRAFFIC

	Y	N	Comments
1. Are appropriate warning signs or barriers used to protect employees who are exposed to vehicular traffic?			
2. Are employees exposed to vehicular traffic provided with and wearing warning vests or other suitable garments marked with or made of reflective or high-visibility material?			

#### F. EXPOSURE TO FALLING LOADS

	Y	N	Comments
1. Are employees permitted underneath loads handled by lifting or digging equipment?			
2. Are employees required to stand away from any vehicle being loaded or unloaded to avoid being stuck by any spillage or falling materials?			
3. Operators should remain in the cabs of vehicles being loaded or unloaded only if the vehicles are equipped, according to 29 CFR Part 1926.601(b)(6), to provide adequate protection for the operator during loading/unloading operations. Are said vehicles so equipped?			

#### G. WARNING SYSTEM FOR MOBILE EQUIPMENT

	Y	N	Comments
1. Does the operator of mobile equipment operated adjacent to an excavation have a clear and direct view of the edge of the excavation?			
2. Is the grade away from the excavation?			
3. If not, and if this such equipment is required to approach the edge of an excavation, is a warning system used (barricades, hand or mechanical signals, or stop logs)?			

## H. HAZARDOUS ATMOSPHERES

	Y	N	Comments
1. Is there potential for hazardous atmosphere in excavations?			
2. If yes, has the atmosphere in the excavations been tested before employees enter?			
3. Is atmosphere monitored at established frequency and documented in Section U, Atmospheric Monitoring Record?			
4. Are adequate precautions taken to prevent employee exposure to atmospheres containing less than 19.5% oxygen and other hazardous atmospheres?			
5. Are adequate precautions are taken to ensure employee exposure is less than 20% lower exposure limit (LEL)?			
6. Is testing conducted as often as necessary to ensure that the atmosphere remains safe?			

## I. EMERGENCY RESCUE EQUIPMENT

	Y	N	Comments
1. Is emergency rescue equipment (breathing apparatus, safety harness and line, basket stretcher, etc.) readily available where hazardous atmospheric conditions exist or may the equipment reasonably be expected to be available during work in an excavation?  Is equipment attended when in use?			
2. Do employees entering bell-bottom pier holes or other similar deep and confined footing excavations wear a harness with a lifeline securely attached? Is the lifeline separate from any line used to handle materials, and is it attended at all times while the employee wearing the lifeline is in the excavation?			

## J. PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

	Y	N	Comments
1. Do employees work in excavations in which there is accumulated water, or in excavations in which water is accumulating?  Have adequate precautions been taken to protect employees against the hazards posed by water accumulation?			
2. If water is controlled or prevented from accumulating by the use of water removal equipment, is the water removal equipment and operation monitored by a competent person to ensure proper operation?			
3. If excavation work interrupts the natural drainage of surface water (such as streams), are diversion ditches, dikes, or other suitable means used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation?			
4. Are excavations subject to runoff from heavy rains inspected by a competent person and are they in compliance with paragraphs 29 CFR 1926.651(h)(1) and (h)(2)?			

## K. STABILITY OF ADJACENT STRUCTURES

	Y	N	Comments
1. Are support systems (shoring, bracing, or underpinning) provided to ensure the stability of such structures where the stability of adjoining buildings, walls, or other structures is endangered by excavation operation?			
2. Excavation below the level of the base or footing of any foundation or retaining wall is not permitted unless:			
- A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure.			
- The excavation is in stable rock.			
- A PE has determined that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity.			
- A PE has determined that such excavation work will not pose a hazard to employees.			
3. Are sidewalks, pavements, and appurtenant structures stable? If they are undermined, is a support system or another method of protection provided to protect employees from the possible collapse of such structures?			

## L. PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

	Y	N	Comments
1. Are employees protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations?			
2. Is adequate protection (such as scaling to remove loose material or installation of protective barricades) provided to protect employees from loose rock or soil falling or rolling from an excavation face?			

## M. INSPECTIONS

	Y	N	Comments
1. Are inspections conducted prior to the start of work and as needed throughout the shift by a competent person?			
2. Are daily inspections of excavations, the adjacent areas, and protective systems made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions?			
3. Are inspections made after every rainstorm or other hazard-increasing occurrence (freezing, thawing, increased vibration, or new traffic pattern)?			
4. Are inspections documented?			

## N. FALL PROTECTION

	Y	N	Comments
1. Are walkways or bridges with standard guardrails provided where employees or equipment are required or permitted to cross over excavations?			
2. Are adequate barrier physical protection (sufficient to provide protection for vehicles or pedestrians as appropriate) and lighting provided at all remotely located excavations?			
3. Are all wells, pits, shafts, etc., barricaded or covered?			

## O. PROTECTION OF EMPLOYEES IN EXCAVATIONS

	Y	N	Comments
1. Each employee in an excavation is protected from cave-ins by an adequate protective system designed in accordance with paragraphs (b) or (c) of 29 CFR Part 1926.652 unless:			
- Excavations are made entirely in stable rock.			
- Excavations are less than 5 ft (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.			
2. Are employees permitted to work on the faces of sloped/benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment?			
3. Do the protective systems have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system?			

## P. DESIGN OF SLOPING AND BENCHING SYSTEMS.

	Y	N	Comments
1. Are slopes and configurations of sloping and benching systems selected and constructed in accordance with the requirements of 29 CFR Part 1926.652:			
- Paragraph (b)(1) (slope angles no greater than 1 1/2:1 [75%] or conforms to slopes and configurations required in Appendix B for type C soils)?			
- Paragraph (b)(2) (slopes and configurations are according to Appendices A and B)?			
- Paragraph (b)(3) (slopes and configurations are according to other published tables that are available onsite)?			
- Paragraph (b)(4) (slopes and configurations are designed by a PE and a copy of the design is onsite)?			

## Q. DESIGN OF SUPPORT SYSTEMS, SHIELD SYSTEMS, AND OTHER PROTECTIVE SYSTEMS.

	Y	N	Comments
1. Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or a designee and shall be in accordance with the requirements of 29 CFR Part 1926.652:			
- Paragraph (c)(1) (designs are based on Appendices A, C, and D)?			
- Paragraph (c)(2) (design is in accordance with manufacturer's tabulated data, specifications, or instructions and a copy of the data is onsite.)?			
- Paragraph (c)(3) (designs use other tabulated data and a copy of the data is onsite)?			
- Paragraph (c)(4) (designed by a PE and a copy of the design is onsite)?			

## R. INSTALLATION AND REMOVAL OF SUPPORT

	Y	N	Comments
1. Are members of support systems securely connected together to prevent sliding, falling, kickouts, or other predictable failure?			
2. Is installation of a support system closely coordinated with the excavation of trenches?			
3. Are support systems installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system?			
4. Are individual members of support systems subjected to loads exceeding those they were designed to withstand?			
5. Before temporary removal of individual members begins, are additional precautions taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system?			
6. Removal begins at, and progresses from, the bottom of the excavation. Are members released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation?			
7. Does backfilling progress together with the removal of support systems from excavations?			
8. Excavation of material to a level no greater than 2 ft (.61 m) below the bottom of the members of a support system is permitted only if: - The system is designed to resist the forces calculated for the full depth of the trench. - There are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.			

## S. SHIELD SYSTEMS

	Y	N	Comments
1. Are shield systems subjected to loads exceeding those the system was designed to withstand?			
2. Are shields installed in a manner to restrict lateral or other hazardous movement of the shield in the event of application of sudden lateral loads?			
3. Are employees protected from the hazard of cave-ins when entering or exiting the areas protected by shields?			
4. Are employees allowed in areas when shields are being installed, removed, or moved vertically?			
5. Excavation of earth material to a level not greater than 2 ft (.61 m) below the bottom of a shield is permitted only if the shield is designed to resist the forces calculated for the full depth of the trench, and if there are no indications, while the trench is open, of a possible loss of soil from behind or below the bottom of the shield.			

## T. ADDITIONAL COMMENTS

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## U. ATMOSPHERIC MONITORING RECORD

[illegible]

## FLD 34 UNDERGROUND UTILITIES

### REFERENCES

29 CFR 1926.651, *Specific Excavation Requirements*  
ANSI Standard Z 535.1, *American National Standard for Safety Color Code*

### RELATED FLDs

*FLD 42 – Lockout/Tagout*

This Field Operation Procedure (FLD) provides requirements for identification, location, and avoidance of underground utilities, appurtenances, and structures during intrusive activities. These requirements are applicable to all Weston Solutions, Inc. (WESTON) operations. The procedures address the requirements and recommendations for identifying and locating, working around, and encountering or contacting underground utilities. The FLD also addresses actions to be taken in response to encountering or contacting underground utilities.

### DEFINITIONS

#### Aggressive Methods

The use of mechanized equipment such as (but not limited to) excavators, backhoes, drill rigs, directional drilling, Geoprobe operations (including all direct push techniques), or road saws.

#### Buffer Zone

As defined in this procedure, the area around a utility where only non-aggressive excavation methods may be utilized, unless specific conditions are met.

The definition cited above, and the excavation requirements and restrictions associated with it, will vary depending on the particular state regulations. WESTON requires the imposition of a **three-foot** Buffer Zone on all sides of the utility as measured from the outside edges of the utility, both horizontally and vertically. State and/or local buffer zone requirements must be verified by consulting the applicable state regulations in the event buffer zones greater than three feet are required.

The term “Buffer Zone” may be referred to as the “Tolerance Zone”, “Safety Zone”, or “Approximate Location of Underground Utilities” in some jurisdictions.

#### Competent Person

A Competent Person has the ability to recognize hazards associated with underground utilities and the authority to stop or direct operations to ensure the safety of personnel and conformance with this procedure. The Competent Person has an understanding of this procedure, and the “One-Call” system requirements for the jurisdiction where excavation is occurring. The Competent Person must be capable of notifying One-Call agencies and maintaining and tracking One-Call Locate Numbers. Additionally, they must have knowledge of methods and work practices for excavation work and the identification, avoidance, and protection of underground utilities.

The designation of a Competent Person will be made by the Site Manager (SM) or Project Manager (PM) and documented in the site-specific Health and Safety Plan (HASP) or attachment to the HASP. Each WESTON Competent Person is required to successfully complete WESTON’s internal training program on the use and application of this FLD and possess appropriate and relevant field experience.

The names of Subcontractor Competent Persons will be documented in the Site-Specific *Subcontractor Acknowledgment: Supervisor Personnel, Competence of Personnel, and Task Understanding* form. Subcontractor Competent Persons will be expected to follow this FLD or their company's procedures, whichever is more restrictive.

### **Damage**

Damage may be considered as any undesired impact or unanticipated removal of support from an underground utility as a result of excavation or demolition. Damage may be as simple as minor contact (by any means) resulting in displacement of protective coating. The utility owner must be contacted regarding any damage or question of damage.

### **De-Energize**

As applicable to a utility, to physically eliminate and/or prevent the presence, transmission, flow, or release of energy or materials which may cause harm to personnel or property.

### **Excavation (Intrusive Activity)**

An operation using mechanized equipment for the purpose of movement or removal of earth, rock, or the materials in the ground, including but not limited to: digging, blasting, augering, test boring, drilling, pile driving, directional drilling, grading, plowing-in, hammering (including hammer-drill soil gas sampling tube installation), pulling-in, jacking-in, trenching, tunneling, structural demolition, milling, scraping, tree and root removal (grubbing), and fence or sign post installation. Note that in some States or jurisdictions, excavation may include hand augering or use of other hand tools.

### **Jurisdiction**

The Authority having legal jurisdiction for establishing and/or enforcing regulations and requirements for notification of excavation activities and associated identification and marking of underground utilities. In the United States, the States have jurisdiction, and most consider the regulations applicable when excavation is to be performed in any location, including any public or private way, any company right-of-way or easement, or any public or privately owned land or way. Note: One caveat to remember – Jurisdiction may flow to the “owner” on private or government-owned property because the State One-Call Agencies may not clear utilities on such facilities.

Note that easement boundaries may require differing methods for compliance assurance. Railroads and certain above ground utilities have easements that require specific procedures for excavation (including shoring and shielding of both the utility as well as for the track and/or poles). In these cases it may be required that an inspector or representative of the railroad or utility is present at all phases of the activity.

### **Locate**

To indicate the existence of a utility by establishing a mark through the use of flags, pins, stakes, paint, or some other customary manner, that *approximately* determines the location of a line or facility.

### **Locate Request**

A communication between an entity performing intrusive activities and a utility marking agency (One-Call, etc).

## Non-Aggressive Methods

Non-Aggressive methods involve the use of manual methods such as hand digging with shovels or by potholing or daylighting methods.

## Observer

The person assigned to visually monitor and, as needed, signal the operator during mechanized intrusive activity when the activity is occurring within three feet of the outside edge of the buffer zone. The observer remains in close communication with the equipment operator(s) and will stop the activity if needed.

## One-Call Agency

An entity that administers a system through which a person can notify owners/operators of underground lines or utilities of the intent to perform intrusive activities in proposed public areas. **It is important to note that not all underground utility owners may be required to join the One-Call system. Additionally, some underground utility owners may not comply with State registration requirements.** The SM or Competent Person is responsible to determine additional utilities that may need to be contacted individually.

## Positive Response

Verification prior to the intrusive activity, to ensure that all contacted (typically via the One-Call Agency) owner/operators have located and marked the underground utilities. The SM or Competent Person is responsible to determine/verify ownership of the property where the intrusive activity will occur, including any easements.

## Potholing or Daylighting

The practice of exposing an underground facility by safe, *non-aggressive* excavation methods in order to determine the precise horizontal and vertical position and orientation of underground lines or utilities. potholing or daylighting are terms used to describe the excavating of buried facilities using an air or water “knife” coupled with vacuum excavation that exposes underground utilizes to the “daylight” – a positive and safe means of identification and confirmation of exact utility location.

## Target Rich Environment

Areas where multiple utilities are known or suspected of being located, areas where utility locations are in question and/or difficult to obtain information on, or areas with known or suspect high-risk utilities. **Note: Military Bases (active or inactive) are to be considered “Target Rich Environments”.**

## Underground Utility

An underground or submerged conductor, pipe, or structure used in transporting or providing electric, communications service, gas, oil or oil product, sewage, storm drainage, water, or other service and appurtenances thereto. As used in this procedure, utility includes all underground appurtenances and structures.

The following are examples of the types of underground utilities that may be present in a given location:

- Natural gas pipelines
- Electric cables

- Water pipelines
- Fiber optic telecommunications lines
- Telephone cable lines
- Steam pipelines
- Gasoline, oil, or other fuels
- Sewer pipelines
- Vents for sewer and gasoline/diesel fueling systems
- Underground Storage Tanks (USTs)
- Abandoned underground structures containing hazardous materials, hazardous wastes, and radioactive materials

### **Underground Utility Owner**

Any person, utility, municipality, authority, political subdivision or other person or entity who owns, operates, or controls the operation of an underground line/facility.

### **White Lining**

The practice whereby the person (in this case WESTON or a Subcontractor) who intends to perform intrusive activities, pre-marks the site with an outline of the area where intrusive activities will occur. This involves the use of white paint, flags, stakes, or a combination thereof to mark the extent of where work is to be performed. The marking may vary depending on what intrusive activities are to be conducted. For example, for general excavation, an areal outline of the excavation shall be marked, while for drilling, the individual boreholes shall be marked. Studies have shown that pre-marking is a practice that does prevent utility contact incidents. Check State or local regulatory requirements to ensure compliance.

## **RESPONSIBILITIES**

### **Competent Person**

The Competent Person shall be responsible for:

- Obtaining a copy of, and understanding the applicable regulations for the state of jurisdiction where the excavation activities are to be performed.
- Contacting the appropriate One-Call Agency or private locating service, as applicable.
- Recording One-Call locate numbers.
- If necessary, renewing One-Call locate numbers before expiration.
- Ensuring that white-lining of the area to be excavated is performed; if another equal or better protective measure is necessary because of the nature of the work, state/local regulation, or client requirements, the HASP should be amended to reflect the change.
- Ensuring that a “positive response” has been received from every utility owner/operator identified by the One-Call Agency (and any non-member utility as necessary) and that they have located their underground utilities and have appropriately marked any potential conflicts with the areas of planned intrusive activities prior to the start of intrusive work.

- Ensuring that appropriate means for supporting and protecting any exposed utility have been discussed with the utility owner and such means are available on-site.
- Ensuring that above-ground utilities and other appurtenances will not create a problem, or be impacted by WESTON activities. In all cases provisions for protection of any utility, structure, or appurtenance must be made.
- Ensuring that provisions for emergency actions and emergency shut-off/mitigation of utilities have been discussed with utility owners and field personnel.
- Ensuring that pictures are taken before, during, and after intrusive activities and placing such pictures in the project file. Pictures should provide visual documentation of actual site conditions, including but not limited to exposed utilities, methods used for bracing utilities and markings placed on the surface by utility locating services. Consideration should also include placing of a known object in the picture field to provide a “scale” for size/distance comparison.
- Completion and maintenance of the Underground Utilities Locating and Marking Checklist (Attachment A) and the Underground Utilities Management Checklist (Attachment B).
- Reviewing applicable Activity Hazard Analyses (AHAs) with all project members before work begins.
- Conducting training on communication protocols to be used by the excavation observer and equipment operator.
- Ensuring implementation of appropriate work practices during intrusive activities (including maintaining the prescribed buffer zone for use of aggressive methods).
- Conducting daily or more frequent (due to changes in conditions) inspections of the excavation area to make sure that all markings are intact.
- Providing the Field Safety Officer (FSO) with all required documentation on a daily basis.

## **Observer**

Whenever intrusive operations with mechanized equipment are being conducted *within three feet of the outside edge of the buffer zone*, horizontally and vertically, an observer must be assigned to monitor the activities. The observer is responsible for:

- Maintaining a safe vantage point relative to digging machinery, excavation edge, and proximity to the hazard posed by the utility.
- Observing the operation to ensure that the operator stops operations if utilities are observed.
- Reviewing hand signals and other forms of communication with the operator. Note: hand signals should be as those identified under ANSI, OSHA, or the Corps of Engineers for Crane Hand Signals, or another, equally effective and understood system.
- Properly signaling the operator.
- Stopping the operation immediately if the observer’s attention must be diverted even momentarily.
- Stopping the operation immediately if a hand signal or other directive is not followed. Operations will not resume until the observer and operator mutually agree that the reason(s) for not complying with the directive(s) are/is identified and fully corrected.
- Maintaining required records, such as logbook entries, or other, as requested by line management.

## Line Management

The PM or SM shall be responsible for:

- Establishing the site culture with the assistance of the FSO that ensures compliance with this FLD, as well as providing the leadership to “do the right thing” whenever unanticipated circumstances arise.
- Providing the necessary resources, including sufficient schedule for compliance with this FLD.
- Designating a Competent Person or ensuring that a subcontractor Competent Person is designated, prior to the start of work.
- Discussing intrusive activity liability with the Client prior to the start of work. Best practices for identification of underground utilities must be included with the proposal and/or HASP, as well as WESTON’s requirement for Client sign-off (if the Client is the property owner or if the Client selects the drilling/intrusive action location) when identifying specific work locations for intrusive activities. In cases where the client, such as EPA, will or cannot sign off on liability or provide indemnification, discussions with the appropriate client representatives on intrusive activities will be documented in the project file.

**Note: In any ‘target-rich’ work environment, best practices must include the requirement for potholing/daylighting or careful hand-digging – whenever possible (at least 5 feet below grade) – since these are recognized processes for visually verifying the exact location of underground utilities while minimizing the potential for utility damage.**

- **For excavations using aggressive methods in target-rich environments**, consideration should be given for establishing an agreement with an Emergency Response Contractor and/or the specific utility owner prior to the start of intrusive activities. This agreement should include specific emergency notification procedures for each utility identified to ensure that timely response can be accomplished in the event of a utility strike.
- Determining/verifying ownership of the property where the intrusive activity will occur, including any easements.
- Contacting all utilities not notified directly by the utility notification center, including those known to local personnel and the property owner.
- Obtaining Profit Center Manager approval for any deviations from this FLD, including best practices, or for addressing any set of circumstances not specifically addressed in this FLD that may place WESTON or its employees at risk.

## Environmental, Health, and Safety Personnel

The FSO shall be responsible for:

- Providing oversight on the implementation of the requirements contained in this FLD.
- Consulting with the PM, SM, Competent Person, and the appropriate Division Environmental, Health, and Safety Manager (DEHSM) (or Corporate EHS) on underground utility issues.
- Acting as the Competent Person or Observer as necessary and qualified.

## Procedure

The following sections provide the requirements and recommendations, which are intended to prevent injury to personnel, damage to infrastructure, and associated indirect effects associated with encountering

or contacting underground utilities during intrusive work. Underground utilities present multiple potential hazards that must be recognized before and during work which occurs near them, therefore, this procedure is divided into sections addressing underground utility identification and location, working around or near underground utilities, and actions to be taken in the event that underground utilities are encountered or contacted. Hazards that may be presented by underground utilities include explosion and fire, electrocution, toxic exposures, pathogens, and drowning.

### Identifying and Locating Underground Utilities

The potential for underground utilities or other subsurface feature (e.g., subsurface mines) must be evaluated as early as possible in the planning phase for any project which involves intrusive activities. The following sections describe various methods for identifying and locating utilities on a site. The *Underground Utilities Locating and Marking Checklist* (Attachment A) and the *Underground Utilities Management Checklist* (Attachment B) must be completed before any activities meeting the definition of excavation are conducted. Attachment A is intended to be used as a guide during the process of locating and marking utilities in the area to be excavated. Attachment B is intended to be used as a guide in the overall process of underground utilities management during the course of the project.

**Note:** Attachments A and B or their equivalents must be used to document compliance with this FLD and will be subject to audit.

Prior to excavation all underground utilities must be located and identified by at least two of the following:

- The Utility Owner
- The Property Owner
- A Private or Public Utility Locating Service
- Review of the most current utility drawing, maps or other available records by an approved WESTON Competent Person
- Use of utility locating technology by a WESTON Competent Person or subcontractor – this includes the use of potholing or daylighting in a “target-rich” work environment or whenever a full clearance (without restrictions) cannot be obtained from a utility locating service.

As an aid in determining the potential for or existence of utilities follow the criteria outlined in Attachment C (Utilities Research Options).

### Pre-Planning and the Site HASP

The site-specific HASP developed for the project must:

- Identify the location and types of underground utilities that are believed to be present on the site.
- Reference this procedure (FLD 34), and describe how it will be implemented on the project.
- Contain an AHA in which the hazards associated with underground utilities are identified, as well as the measures used to control them.
- Contain any site or contract-specific requirements (e.g., Corps of Engineers, EM 385-1-1, Section 25) that may be applicable.
- Contain clear and concise procedures to be followed in the event that contact with underground utilities occurs.

- Address underground utilities and potential associated scenarios in the emergency response section of the HASP.








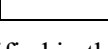
#### “One-Call” Locating and Marking Services

Every state has utility marking service programs that have various names such as “One-Call”, “Dig-Safe”, “Call-Before-You-Dig”, “Dig-Safely”, and many others. These services will identify the types and locations of any utility that may exist in an area to be excavated, as long as the property is in the public domain.

- The appropriate One-Call service for the jurisdiction where the project is located must be contacted prior to beginning excavation work. The One-Call Agency should be given as detailed a description of the property as possible; address, cross street, utility pole numbers, physical description, etc.
- Notification to the One-Call service shall allow sufficient lead-time for the Agency to mark the utilities before excavation begins. The lead times vary, but range from two to ten days, depending on the state of jurisdiction.
- In the event the State or Local One-Call service number is in question call "811" (the Federal Call before You Dig Number) for access to the appropriate locator service.
- A complete listing of One-Call agencies and telephone numbers for all states is available in the “*Call-Before-You-Dig Call Center Directory*”, which can be accessed on the Internet at the WebPage (<http://underspace.com/index.htm>) sponsored by “*Underground Focus*” magazine.
- Once notified, the One-Call Agency will provide the contractor with a unique “locate number” or “reference number”. This reference number must be kept in the project files by the Competent Person or designee. Additionally, the reference numbers have expiration dates, which may vary depending on the particular One-Call Agency. The valid period of the locate number and required renew notification date shall be requested from the One-Call Agency.
- On a project with multiple contractors, each contractor must request a separate locate number. Under no circumstances will any other contractor or entity be allowed to “work under our locate number”. Subcontractors to WESTON may excavate under the locate number secured by WESTON, provided that they are excavating within the area which was previously white-lined by WESTON and subsequently marked. **However, the One-Call Agency must be contacted and notified of this arrangement so that the subcontractor can be recorded as working under the existing locate number.** If a WESTON subcontractor will be excavating in an area not white-lined by WESTON, then the WESTON subcontractor must request a new locate. **Note: State and local requirements must be checked for local application of this procedure.**
- The area where work is to be performed shall be white-lined before the locating service goes to the site.
- It is good practice to arrange a pre-excavation meeting at the project site with the personnel performing the utility location and marking. This meeting will facilitate communications, coordinate the marking with actual excavation, and assure identification of high-priority utilities.
- The One-Call Agency should provide the identities of the utility owners that will be notified of the locate request. This information shall be recorded on the Underground Utilities Locating and Marking Checklist (Appendix A) and maintained in the project files. The contact person and phone number for each utility owner shall also be recorded. ***Note that all utility owners are not members of the One-Call system.*** This does not eliminate the need to contact a non-member owner if you have knowledge or suspect that excavation will impact their utility.

- The utility owners should provide a “positive response” relative to the locate request, which can consist of two types of action by the utility owner. The facility owner or operator is required to 1) mark its underground utilities with stakes, paint, or flags, or 2) notify the excavator that the utility owner/operator has no underground utilities in the area of the excavation.
- The positive responses shall be recorded on the Underground Utilities Locating and Marking Checklist (Attachment A) and crosschecked with the list of utility owners that the One-Call Agency stated they would notify. If it is discovered that a utility owner has not provided a positive response, then the One-Call Agency must be notified.
- Excavation shall not be conducted until positive responses have been received from all utility owners identified by the One-Call Agency as having underground utilities on the property.
- Before beginning excavation, the excavator must verify that the location marked was correct, and the distinct, color-coded markings of all utility owners are present.
- Examine the site to check for any visible signs of underground utilities that have not been located and marked such as pedestals, risers, meters, warning signs, manholes, pull boxes, valve boxes, patched asphalt or concrete pavement, areas of subsidence, fresh sod or grass, lack of grass or vegetation, and new trench lines.
- The markings placed by the utility owners should be documented by WESTON using a still, digital, or video camera, whenever practical and reasonable. The photo-documentation shall be maintained with the project files.
- The markings placed by the utility owners or marking services typically follow the American Public Works Association Uniform Color Code as described in ANSI Standard Z 535.1. This code follows:

#### **American Public Works Association Uniform Color Code**

Red		Electric Power Lines, Cables, Conduit
Orange		Communications, Telephone, Cable TV
Yellow		Gas, Oil, Steam, Petroleum or Gaseous Materials
Green		Sewers and Drains
Blue		Potable Water Systems
Purple		Reclaimed Water, Irrigation, Slurry Lines
Pink		Temporary Survey Markings
White		Proposed Excavation

**Note:** Unless otherwise specified in the utility clearance, such clearance will not be considered valid after 30 days from the date it was issued.

#### Private Utility Locating and Marking Services

- **One-Call agencies arrange for the identification and marking of underground utilities only on public property, up to the point of contact with private property.** In the event that activities are to be conducted on non-public properties, the presence, location, depth, and orientation of all underground utilities shall be ascertained through records review, including any site plot plans, utility layout plans, and as-built drawings available from the property owner, as well as through interviews with knowledgeable personnel associated with the property (See Attachment C). Additionally, for excavations using aggressive methods in target-rich

environments or other situations where utility locations are in question, the information gathered from these sources shall be verified by physical detection methods (non-aggressive), performance of a geophysical survey, or by procuring the services of a private utility locating and marking service. If any detection methods are to be self-performed, the requirements within this FLD must be followed. **A list of vendors providing this service can be found in the “Network of Underground Damage Prevention Professionals” which can be accessed on the Internet at the “Underspace” WebPage (<http://underspace.com/index.htm>).**

#### Self-Performance of Utility Locating and Marking

The techniques and instruments used to locate and characterize underground utilities can be extremely complicated and difficult to use effectively. Additionally, interpretation of the data generated by this instrumentation can be difficult. The utility marking services, as previously described are staffed by well-trained, experienced professionals who perform locating activities on a regular basis. For these reasons, it is most desirable that these professional services are used for utility location and marking on projects.

- In some instances on private property or in other areas not served by One-Call agencies (e.g., long-term projects where excavation is a primary task, and the presence of underground utilities is extensive) it may be prudent to self-perform locating and marking activities.
- If locating and marking is to be self-performed, all personnel using instrumentation will be trained on the use of the equipment that will be used, and the interpretation of the data.
- There are a variety of locating methods which may be utilized for self-performance of utility locating as categorized below:
  - Magnetic field-based locators or path tracers
  - Buried electronic marker systems (EMS)
  - Ground penetration radar-based buried –structure detectors
  - Acoustics-based plastic pipe locators
  - Active probes, beacons, or sondes for non-metallic pipes
  - Magnetic polyethylene pipe
- Before self-performing any underground utility locating on a project, approval must be obtained from the appropriate WESTON DEHSM or the Corporate EHS Director.

#### **Working Near or Around Underground Utilities**

After the site has been properly evaluated for the presence of aboveground utilities, underground utilities, and other appurtenances, intrusive activities may begin. Because there is no perfect way of eliminating the hazards presented by underground utilities, an effort must be made to perform the tasks following the direction and guidance as described by the following best practices that should be implemented during the execution of the project.

#### Work Site Review

Before beginning intrusive activities, a meeting shall be held between all members of the project team. This shall consist of a review of the marked utility locations with the equipment operators, observers, laborers, etc.

#### Preservation of Marks

During excavation, efforts must be made to preserve the markings placed by the utility owners until they are no longer required. If any markings are obliterated, the One-Call Agency must be contacted for re-marking. No intrusive activities are to take place if markings are not visible.

### Excavation Observer

Whenever intrusive operations are being conducted within three feet of the edge of the buffer zone, an observer must be assigned to monitor the activities. The observer will be designated each day, and a review of hand signals and other forms of communication between the observer and operator will be conducted. The directives of the observer will be followed precisely and immediately by those operating equipment.

### Excavation Within The Buffer Zone

Mechanical means of excavation may not be used within 36 inches (see Buffer Zone) of any marked or suspect utility until the utility has been exposed. Mechanical methods may be used, as necessary, for initial penetration and removal of pavement, rock or other materials requiring use of mechanical means of excavation provided a spotter is used. Once the underground utility has been exposed, further excavation must be performed, employing reasonable precautions to avoid damage to the utility, including but not limited to any substantial weakening of structural or lateral support, or penetration or destruction of the utility or its protective coatings. For purposes of this section, “mechanical means of excavation” means excavation using any device or tool powered by an engine except air vacuum or like methods of excavation.

A request to utilize aggressive excavation methods in the buffer zone may be made if:

- There is no other appropriate and reasonable alternative to using aggressive methods in the buffer zone; and
- The utility has been de-energized (and purged if necessary), verified as de-energized, and locked-out; or
- The depth and orientation of the utility has been adequately and visually determined through the use of non-aggressive methods such as air/hydro/vacuum excavation, potholing, probing, hand-digging, or a combination thereof; and
- For utilities containing electrical energy, the depth of the existing water table is below the location of the utility; and
- Request for the exemption has been submitted to the appropriate DEHSM and Profit Center Manager for approval.

The following conditions will apply to this request:

- Aggressive methods may be used in the buffer zone only to the extent allowed by the applicable state or other jurisdictional regulations.
- Appropriate physical protection measures for exposed utilities shall be implemented to eliminate the potential for equipment contact with utilities.
- The extent of the project excavation area to be covered by the exemption request must be specified in the request for exemption.
- When evaluating the use of aggressive excavation methods in the buffer zone, the DEHSM will consider the type of utility involved and the associated risk potential. Based on this evaluation, the Profit Center Manager and/or DEHSM may impose further conditions and requirements. Even if the above exemption conditions are met, the DEHSM has authority to deny the request.

Unless exempted according to the above provisions of this procedure, only non-aggressive methods may be used within the buffer zone. These methods are used in order to prevent mechanical contact with underground utilities, which could result in damage to the utility and create the potential for personal injury and property damage. Following are examples of non-aggressive excavation methods:

- Hand-digging
  - Non-conductive hand tools must be used when digging within the buffer zone surrounding underground electrical utilities.
  - If conductive hand tools must be used near electrical lines, then the FSO and/or DEHSM shall be consulted to determine additional requirements relative to safe electrical practices, procedures, and equipment.
- Hydro-excavation (water pressure).
- Air excavation (air pressure).
- Vacuum extraction (soil excavation/removal).
- Air excavation/vacuum extraction combination.
- Aggressive methods may be used for the removal of pavement over a utility, if allowed by the state regulations.

#### Protection of Underground Utilities

It is very important that consideration be given to the protection of underground utilities when performing adjacent intrusive activities. This is necessary not only to prevent physical damage and associated indirect effects, but also to prevent the potential for injury to employees and the public.

- When using aggressive excavation methods within the buffer zone around exposed underground utilities, physical protection must be used as required by OSHA in 29 CFR 1926.651. Basically, this involves creation of a physical barrier between the mechanized operation and the utility. The following are some possible types of physical protective measures:
  - Heavy timbers, similar to swamp or crane mats.
  - Sheets of plywood.
  - Blasting mats.
- Once exposed, underground utilities no longer have the support provided by surrounding soil and may need to be physically supported to prevent shifting, bending, separation, or collapse, which could result in damage to the utility, and possibly personnel. Following are suggested support methods:
  - Timber shoring underneath the utility.
  - Timbers or girders over the top of the excavation fitted with hangers that support the utility.
  - Design by a Professional Engineer for complicated or large applications.
- Utilities must also be protected from objects that may fall into the excavation such as rocks and equipment. This can be accomplished by following these guidelines:
  - Cast spoils as far away from the excavation as possible. Excavated and loose materials shall be kept a minimum of two feet from the edge of excavations.
  - Relocate large rocks, cobbles, and boulders away from the excavation and sloped spoils piles.

- When vehicles and machinery are operating adjacent to excavations, warning systems such as soil berms, stop logs or barricades shall be utilized to prevent vehicles from entering the excavation or trench.
- Scaling or barricades shall be used to prevent rock and soils from falling into the excavation.
- Barriers shall be provided to prevent personnel from inadvertently falling into an excavation.

### De-Energizing Utilities

Utilities can carry many types of potential energy, including electricity, flowing liquids, liquids under pressure, or gasses under pressure. A release may happen if a utility conveyance is compromised and could result in personal injury, property damage, and other indirect effects. If the white lines of the proposed excavation area overlaps or extends into the buffer zone of a known underground utility, then if at all possible, that utility should be de-energized to physically prevent the transmission, flow, or release of energy. Conversely, if the buffer zone of the known utility lies outside of the white-lined, proposed excavation area, then de-energizing is not required.

- The owner of the utility shall be contacted to determine the feasibility and methodology of de-energizing the utility. Plenty of lead-time should be provided for this since it may take utility companies weeks to de-energize some utilities.
- Depending on the utility and the material being conveyed, isolation points which may be suitable for de-energizing include but are not limited to the following:
  - Electrical circuit breakers
  - Slide gate
  - Disconnect switches
  - Piping flanges
  - Other similar devices
- When utilities are de-energized, it must be verified by demonstration. This can be accomplished by methods such as, testing equipment, switching on a machine or lighting, or opening a valve. For any current-carrying electrical equipment, such as cables or electrical panels, successful de-energizing must be certified through the use of appropriate electrical testing equipment and qualified personnel.
- Whenever a utility is de-energized, a means of ensuring that the energy isolation device and equipment cannot be operated until the device is removed must be provided.
- When de-energizing and locking out of utilities is practiced, the provisions of FLD 42 Lockout/Tagout shall be followed, as applicable.

### Damage Discovery

During excavation, utility damage may be discovered which is pre-existing or otherwise not related to a known contact. Disclosure to the utility owner is very important because the possibility of utility failure or endangerment of the surrounding population increases when damage has occurred. The utility may not immediately fail as a result of damage, but the utility owner or operator must be afforded the opportunity to inspect the utility and make a damage assessment and effect repairs if necessary. The following guidance applies:

- Observe and photograph the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, or other damages to utility lines, conduits, coatings, or cathodic protection systems.

- The owner of the affected utility must be contacted immediately.
- The One-Call Agency or private location service must be contacted immediately.
- A Notification of Incident (NOI) Report will be used to document such a discovery.

#### Encountering Unexpected Underground Utilities

It is possible that underground utilities will be encountered in locations that have previously been “cleared” of having underground utilities by the locating service, or are found outside of the area, which has been marked as having underground utilities. In either case, if this occurs, the following applies:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.
- Intrusive activities must be stopped.
- The owner of the affected utility must be immediately contacted.
- The One-Call Agency or private location service must be contacted immediately.
- The PM, SM, and FSO must be notified.
- No further intrusive activities may be conducted until:
  - The One-Call Agency/private location service and/or the subject utility owner visit the site;
  - Identification of the utility owner and the type of material/energy being conveyed by the utility has been made; and
  - The orientation and depth of the subject utility has been determined and suitably marked.
- A NOI Report must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.

#### Contacting Underground Utilities

If excavation or other equipment being used for intrusive activities makes contact with an underground utility, the following guidelines apply:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.
- Intrusive activities must be stopped immediately.
- Observe the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, scratched coatings, cathodic protection compromise, material leakage, obvious electrical energy.
- Move all personnel to the evacuation meeting point as described in the HASP.

***EXCEPTION:*** *If an electrical line has been contacted and it is your belief that equipment (such as an excavator) is electrically energized, do not approach the equipment. Order the operator to remain in the equipment until emergency personnel can de-energize the source (unless the equipment is on fire, at which time the operator should jump off of the vehicle and shuffle along the ground to a safe area). Shuffling is required because current flows outward through the soil in a ripple pattern called a power gradient, creating a pattern of high and low potential, Shuffling decreases the chance that these gradients could be bridged, causing current to flow through the body, resulting in electrocution.*

- Secure the area to prevent the public from entering.
- Contact emergency responders as specified in the HASP.
- Immediately contact the One-Call Agency or if known, the utility owner.
- Notify the PM, SM, FSO and DEHSM.
- No further intrusive activities may be conducted until:
  - The utility owner inspects the scene and after repairs, verifies that all danger has passed.
  - The orientation and depth of the subject utility has been determined and suitably marked.
  - Permission from the emergency responders to resume work has been given.
- A WESTON NOI Report must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.
- State and Local regulations must be reviewed to determine if reporting to any additional agencies is required.

## **ATTACHMENTS**

Attachment A – Underground Utilities Locating and Marking Checklist

Attachment B – Underground Utilities Management Checklist

Attachment C – Utilities Research Options

Attachment D – Sources of Information

Informational Addendum 16 June 2010

**ATTACHMENT A**  
**UNDERGROUND UTILITIES LOCATING AND MARKING CHECKLIST**

*Weston Solutions, Inc.*

To be Completed by PM and/or "Competent Person"  
Complete Form as Location/Marking Progresses and Maintain in Site Files

<b>PROJECT INFORMATION:</b>	<b>Location:</b>
<b>Project Name:</b>	Task/Activity:
WESTON Competent Person:	Start Date of Work:
WESTON Subcontractor: <input type="checkbox"/> No <input type="checkbox"/> Yes:	Private Locating Service Required: <input type="checkbox"/> Yes <input type="checkbox"/> No
Subcontractor Competent Person:	If Not, Explain:
Property Owner:	
<b>NOTIFICATION:</b>	
<b>Locating Service Name:</b>	Locating Service Tel. Number:
Date Locating Service Notified:	Locate Ticket Number:
Address of Property to be Marked:	Locate Ticket Expiration Date:
Nearest Intersecting Street:	
Are There Any Utilities on the Properties That the Locating Service Will Not Contact? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Specify:	

*Enter Utility Information in Table 1 Below. In Addition to Utility Locating Services, Consult Client, Utility Owners, Drawings, Facility Personnel, Maintenance Personnel, Municipalities (See Appendix C).*

**Table 1. On-Site Utility Information**

Name of Utility Company	Type of Utility	Color Code	Utility Present On-Site?	Emergency Phone Number	Date Marks Completed
	Electric	RED			
	Communications, Phone, CATV	ORANGE			
	Gas, Oil, Steam, Petroleum	YELLOW			
	Sewers, Drains	GREEN			
	Potable Water	BLUE			
	Reclaimed Water, Irrigation	PURPLE			
	Temporary Survey Markings	PINK			
To be performed by excavator prior to utility mark-out.	Proposed Excavation	WHITE			

White-Lining Completed?

☐ No Explain: \_\_\_\_\_ ☐ Yes: Date: \_\_\_\_\_ By Whom? \_\_\_\_\_

### **LOCATING AND MARKING:**

Have All Utilities Identified in Table 1 Been Marked?

☐ Yes ☐ No (If No, Contact Locating Service for Resolution)

Problem(s) With Markings?

☐ Yes ☐ No ☐ No Marks ☐ Incorrect Location ☐ Too Wide

☐ Other: \_\_\_\_\_ ☐ Not All Utilities Marked Per Table 1 (notify marking service)

Measurements Taken: ☐ Yes ☐ No

Documentation of Marks: ☐ Photos ☐ Video ☐ Other: \_\_\_\_\_

### **EXCAVATION:**

Utilities Accurately Marked? ☐ Yes ☐ No

If no, describe: \_\_\_\_\_

Were Unmarked or Mis-Marked Utilities Encountered? ☐ Yes ☐ No

If Yes, Specify: \_\_\_\_\_

Locating Service Notified? ☐ Yes ☐ No

Will Excavation Continue Past Locate Number Expiration? ☐ Yes ☐ No

If Yes, Locate Number Renewed? ☐ Yes ☐ No New Expiration Date: \_\_\_\_\_

Any Other Problems/Concerns? Specify: \_\_\_\_\_

Form Completed By:	Signature:	Date:
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**ATTACHMENT B**  
**UNDERGROUND UTILITIES MANAGEMENT CHECKLIST**

*Weston Solutions, Inc.*

To be Completed by PM and/or “Competent Person”

Complete Form as Project Progresses and Maintain in Site Files.

PHASE	TASK	YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
<b>Pre-Planning</b>	1    Excavation/Best Practices in Work Scope?				
	2    Underground Utilities Identified?				
	3    Competent Person Assigned?				
	4    Has a Copy of the Applicable State Regulations Been Obtained, Read, Understood?				
	5    EHS Plan Addresses Underground Utilities? (AHAs, Contingency Plan, State Regulations Appendix)				
<b>Identifying, Locating and Marking</b>	6    Locating and Marking Checklist Initiated? (Attachment A)				
	7    Identification and Address of Property Determined, Including Nearest Intersection?				
	8    One-Call Agency Contacted?				
	9    Additional Locating and Marking Required on Property? (One-Call agency marks to public property line only)				
	10    Additional Marker/Locator Identified?				
	11    Additional Marker/Locator Qualified?				
	12    Weston Self-Performing Location and Marking?				
	13    If Yes to 12 Above, Approval From Division EHS Manager?				
	14    Area of Excavation “White-Lined” by WESTON?				
	15    WESTON Present When Markings Completed?				
	16    All Utilities Marked? (Refer to Attachment A, Table 1)				
	17    All Markings Photo/Video Documented?				

PHASE	TASK		YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
<b>Identifying, Locating and Marking – Continued</b>	18	Area Checked for Signs of Previous Excavation? (Subsidence, new grass, patching, etc)				
	19	All Applicable Information Recorded on Attachment A?				
	20	Multiple Contractors Excavating On-Site?				
	21	Separate Locate Requests for All Contractors?				
	22	WESTON Subcontractors Excavating in WESTON White- Lined Area(s)?				
	23	If Yes to 22 Above, One-Call Agency Contacted to Determine if WESTON Subcontractor Can be Added to Existing Locate Ticket?				
<b>Excavation Activities</b>	24	Meeting and Site Walkover Conducted with Project Personnel?  (Managers, Equipment Operators, Laborers, Competent Person, Excavation Observer, etc)				
	25	AHA and HASP Review Conducted With Personnel?				
	26	Do Site Activities Have Potential to Obliterate Utility Markings?				
	27	If Yes to 26 Above, Have Provisions Been Made to Preserve Markings?				
	28	Has an Excavation Observer Been Designated to Monitor Excavation When Occurring within 3 Feet of the Buffer Zone?				
	29	Have Operator and Observer Reviewed Commands and Signals?				
	30	Has WESTON-Required Buffer Zone Been Marked on Either Side of Markings Placed by Locator?				

PHASE	TASK		YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
<b>Excavation Within Buffer Zone</b>	31	Is Excavation Within The Buffer Zone Absolutely Necessary?				
	32	If Yes to 31 Above, Can Non-Aggressive Methods Be Used For Excavation In The Buffer Zone? If Yes, Identify Appropriate Non-Aggressive Methods.				
	33	If No to 32 Above, Has a Buffer Zone Exemption Request Been Approved? If No, then Aggressive Methods May Not Be Used in The Buffer Zone.				
	34	If Yes to 33 Above, Has the Utility Been De-Energized, Purged, Verified/Tested, and Locked-Out? Or,  Has The Depth and Orientation of the Utility Been Adequately and Visually Determined Through The Use of Non-Aggressive Methods?				
	35	If Yes to 34 Above, Have All of The Following Conditions Been Met?  For Utilities Containing Electrical Energy, Is The Depth of The Water Table Below The Depth of The Utility?  Have Regulations Been Consulted to Determine Specific State Requirements Relative to Excavating in The Buffer Zone?  Have Appropriate Physical Protection Measures Been Implemented to Prevent Equipment Contact With Utilities and to Prevent Damage to Utilities?  If No to Any of The Above Conditions, Then Only Non-Aggressive Excavation Methods May Conducted in The Buffer Zone, Since The Conditions of The Exemption Have Not Been Satisfied.				
<b>Working Around Exposed Utilities</b>	36	If Necessary, Have Provisions Been Made to Support the Utility During Work Activities?				
	37	Have Spoils Been Placed as far Away From the Excavation as Feasible?				

PHASE	TASK		YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
<b>Working Around Exposed Utilities – Continued</b>	38	Has the Utility Been De-Energized? (If Any Portion of the Buffer Zone around a Utility is Inside of the White-Lined Area)				
	39	Has the Isolation Point for the De-Energized Utility Been Physically Locked-Out?				
	40	If No to 39 Above, Has a Spotter Been Assigned to Monitor Isolation Point?				
	41	If Yes to 40 Above, Does the Spotter Have Adequate Communications? (Radio, Telephone, etc)				
	42	Has the Isolation Point Been Tagged?				
<b>Damage Discovery</b>	43	Has Pre-Existing Damage to a Utility Been Discovered During Excavation?				
	44	If Yes to 43 Above, Has the One-Call Agency and/or Utility Owner Been Notified?				
	45	If Yes to 43 Above, Have Photographs Been taken?				
<b>Encountering or Contacting Underground Utilities</b>	46	Have Utilities Been Encountered in Locations That Have Not Been Marked?				
	47	If Yes to 46 Above, Has the One-Call Agency or Other Locating Service Been Contacted?				
	48	If Yes to 46 Above, Has the PM and Appropriate DSM Been Notified?				
	49	If Yes to 46 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				
	50	Have Excavation Equipment Come In Contact With Underground utilities?				
	51	If Yes to 50 Above, Were Intrusive Activities Immediately Curtailed?				

PHASE	TASK		YES	NO	NA	COMMENTS
						Required if Response is No or NA. (Reference Item Number)
<b>Encountering or Contacting Underground Utilities – Continued</b>	52	If Yes to 50 Above, Has a Damage Determination Been Made From a Safe Distance?				
	53	If Yes to 50 Above, Has the Area Been Secured?				
	54	If Yes to 50 Above, Have Emergency Responders Been Notified?				
	55	If Yes to 50 Above, Has the Locating Agency and/or Utility Owner Been Notified?				
	56	If Yes to 50 Above, Have State and Local Reporting Requirements Been Met?				
	57	If Yes to 50 Above, Were Intrusive Activities Curtailed Until Inspection From Utility Owner, Orientation and Depth of Utility Was Determined and Marked, Permission From Emergency Responders Given?				
	58	If Yes to 50 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				

CHECKLIST COMPLETED BY:

\_\_\_\_\_

NAME

\_\_\_\_\_

SIGNATURE

\_\_\_\_\_

DATE

\_\_\_\_\_

NAME

\_\_\_\_\_

SIGNATURE

\_\_\_\_\_

DATE

**ATTACHMENT C**  
**UTILITY RESEARCH OPTIONS**

In the course of determining and verifying underground utility location it is expected that a minimum of two resources will be used. As a means of assisting the search for sources, the following is offered.

Records Sources:

- ☐ Utility Section of the State DOT or other Public Agency
- ☐ One-Call Center
- ☐ Public Service Commission or similar organization
- ☐ County Clerks Office
- ☐ Landowner
- ☐ Internet or Computer database
- ☐ Visual Site Inspection
- ☐ Utility Owner

From the Above Collect:

- ☐ Previous construction plans in the area
- ☐ Conduit maps
- ☐ Direct-Buried Cable records
- ☐ Distribution maps
- ☐ Service record maps
- ☐ As-built and record drawings
- ☐ Field notes
- ☐ County, city, utility owner or other geographic information system database
- ☐ Circuit diagrams
- ☐ Oral histories (current or previous employees, residents).

Review Records and Obtain Information For:

- ☐ Indications of additional and/or other available records
- ☐ Duplicate information that lends credibility to data
- ☐ Any additional need for clarifications from owners/others

## **ATTACHMENT D SOURCES OF INFORMATION**

### Organizations

- Common Ground Alliance  
<http://www.commongroundalliance.com/wc.dll?cga~toppage>
- Center for Subsurface Strategic Action (CSSA)  
<http://underspace.com/cs/index.htm>
- DigSafely  
<http://www.digsafely.com/digsafely/default.asp>
- National Utility Contractors Association (NUCA)  
<http://www.nuca.com/>
- National Utility Locating Contractors Association (NULCA)  
<http://underspace.com/nu/index.htm>
- Underground Focus Magazine  
<http://underspace.com/uf/index.htm>
- NUCA State Listing of One-Call centers  
<http://www.nuca.com/>
- Utility Safety Magazine  
<http://www.utilitysafety.com/>

### Vendors and Commercial Sites

- RadioDetection, Inc. (Detection Instruments)  
<http://www.radiodee.com/>
- Heath Consultants (Detection Instruments)  
<http://www.heathus.com/>
- Ben Meadows Company (Detection Instruments)  
<http://www.benmeadows.com/cgi-bin/SoftCart.exe/index.html?E+scstore>
- So-Deep, Inc. (Complete Utilities Services)  
<http://www.sodeep.com/>
- Concept Engineering Group, Inc. (Air Excavation Equipment)  
<http://www.air-spade.com/index.html>
- Rycom Instruments, Inc. (Detection Instruments)  
<http://www.rycominstruments.com/>

- Schonstedt Instrument Company (Detection Instruments)  
<http://www.schonstedt.com/>
- Forestry Suppliers, Inc. (Fiberglass Probe – “Fiberglass Tile Probe”, Part #77543,  
Approx. \$20.00, Telephone 800-647-5368)  
<http://www.forestry-suppliers.com/>

## **REFERENCES**

Common Ground Study of One-Call Systems and Damage Prevention Best Practices, August 1999,  
Sponsored by US DOT.

## **FLD 35 ELECTRICAL SAFETY**

### **RELATED FLDs**

*FLD 02 – Inclement Weather*

*FLD 08 – Confined Space Entry Program*

*FLD 24 – Aerial Lifts/Manlifts*

*FLD 25 – Working at Elevation/Fall Protection*

*FLD 26 – Ladders*

*FLD 27 – Scaffolding*

*FLD 34 – Utilities*

*FLD 38 – Hand and Power Hand Tools*

*FLD 42 – Lockout/Tagout*

*FLD 56 – Drilling Safety*

### **PROCEDURE**

Before work is begun, the person in charge will ascertain by inquiry, by direct observation, or by instruments, whether any part of an electric power circuit (exposed or concealed) is located such that the performance of work could bring any person, tool, or machine into physical or electrical contact with it. Sources will be labeled and, if at all possible, electrical conductors and equipment will be de-energized. If electrical conductors and equipment cannot be de-energized, work areas will be provided with shielding or located at sufficient distance from electrical sources to prevent contact or arcing to personnel or equipment. Checks must be made for overhead as well as underground electric lines.

Work around overhead and underground utilities is described in FLD 34. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (National Fire Protection Association [NFPA] 70E with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B) and USCG regulations.

Electrical work will be performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements. A qualified person (electrical) is one who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety and health training on the hazards involved.

All electrical wiring and equipment will be a type listed by a nationally recognized testing laboratory for the specific application for which it is to be used.

Whenever possible, all equipment and circuits to be worked on will be de-energized before work is started and personnel protected by clearance procedures, lockout/tagout, and grounding.

WESTON lockout tag-out procedures (FLD 42) will be used when de-energizing equipment as well as the following procedures applicable to de-energizing.

When it is necessary to work on energized lines or equipment, rubber gloves and other protective equipment, or hotline tools meeting the provisions of American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) standards will be used.

## **Electrical Flash Protection**

Hazardous flash can occur in any electrical device, regardless of voltage, in which energy is high enough to sustain an arc. This includes many 440V motor control centers, panel boards, and switch boards. An arc of this type, while typically less than a second in duration, can reach temperatures in excess of 14,000° F – high enough to produce extensive first degree burns, permanent blindness, or death.

NFPA 70E specifies boundaries within which flash protection is required in an effort to reduce the extent of injuries. Protective equipment is also specified including flash-resistant clothing and face shielding. Boundary distances vary depending on both the qualifications of the person being exposed and the voltage involved. Unqualified personnel must be accompanied by qualified personnel. All personnel within the defined boundaries must wear specified protective equipment.

Whenever it is necessary to work on energized parts greater than 50 volts to ground, a risk/hazard analysis will be conducted in accordance with NFPA 70E, 2004 Article 130, by a qualified person. This assessment will address hazards and risk of electrocution, arc flash, and explosion. Electrical shock and Arc Flash boundaries will be determined and protective procedures including use of engineering controls, administrative controls (Permitting procedures and outage procedures), and PPE will be established.

## **General Safety Requirements**

All lights positioned directly above working areas will be enclosed in cages or similar enclosures to prevent loose or detached lamps or vapor tight enclosures from falling on workers.

Ensure that all plug receptacles are the three-prong, U-blade, grounded type and have adequate current carrying capacity for the electrical tools that may be used.

Ensure that all electric tools have three-prong, U-blade, ground wire plugs and cords or are double insulated.

Do not use electrical tools with lock-on devices.

Ensure that all electrical welders, generators, control panels, and similar devices are adequately grounded.

Ensure that power is turned off before changing fuses or light bulbs.

Ensure that all electrical equipment is operated by trained, designated personnel.

If you are not qualified to work on electrical devices or on electric lines, do not go near them.

Ground fault circuit interrupters (GFCI) will be used on construction sites for all 110 to 115 volt 15 to 20 amp outlets, in the absence of properly grounded circuitry or when portable tools must be used around wet areas.

Electric lines, cables, and extension cords must be appropriately guarded and maintained in good condition.

No work will be done on electrical lines or electrically activated equipment until verification is made that service has been disconnected and/or the system has been locked and tagged out, and the individual doing the work has sole possession of a key to the lock on the lock-out hasp. Protective grounds must also be provided and all work accomplished within the protective grounds.

## Extension Cords

- Must meet Underwriter's Laboratory (UL), Factory Mutual (FM), or other rating criteria according to Occupational Safety and Health Administration (OSHA).
- Extension cord sets used with portable electric tools and appliances will be of three-wire type and will be designed for hard or extra-hard usage. Flexible cords used with temporary and portable lights will be designed for hard or extra-hard usage.
- **NOTE:** The National Electrical Code, ANSI/NFPA 70, in Article 400, Table 400-4, lists various types of flexible cords, some of which are noted as being designed for hard or extra-hard usage. Examples of these types of flexible cords include hard service cord (types S, ST, SO, STO) and junior hard service cord (types SJ, SJO, SJT, SJTO).
- Use will be limited to essential tasks.
- Must be tested for continuity before each use and must be connected to grounded outlets, or GFCIs must be used.
- GFCIs must be integrated into or used on all 120 Volt, 15 - 20 Amp circuits on construction sites and in wet areas.
- Must be inspected daily for loose insulation, broken or missing plugs, bared wires, or other hazards and must not be used for lifting or tying off.
- Will be disconnected by pulling on the plug.
- Grounding of outlets used for portable tools and GFCI must be confirmed before use.
- Must not be allowed to become tripping or slipping hazards and must be protected from damage.
- Must not be run through holes in walls, ceilings, or floors.

## PPE - Electrical

Persons working on electrical distribution systems will be provided with the appropriate electrical protective equipment, which will be inspected, tested, and maintained in safe condition in accordance with the standards referenced in Table 1.

Employees may use rubber gloves, sleeves, blankets, covers, and line hose only when required by special conditions for work on energized facilities. Rubber goods provided to protect employees who work on energized facilities must meet ASTM specifications. Electrical workers' rubber insulating protective equipment will be visually inspected for damage and defects prior to each use.

**TABLE 1**  
**STANDARDS FOR ELECTRICAL PROTECTIVE EQUIPMENT**

SUBJECT	NUMBER AND TITLE
Head Protection	ANSI Z89.1, <i>Requirements for Protective Headwear for Industrial Workers</i>
Eye and face protection	ANSI/ASSE Z87.1, <i>Practice for Occupational and Educational Eye and Face Protection</i>
Gloves	ASTM D120-02, <i>Standard Specification for Rubber Insulating Gloves</i>
Sleeves	ASTM D1051-02, <i>Standard Specification for Rubber Insulating Sleeves</i>
Gloves and sleeves	ASTM F496-02, <i>Standard Specification for In-Service Care of Insulating Gloves and Sleeves</i>
Leather protectors	ASTM F696-02, <i>Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens</i>

SUBJECT	NUMBER AND TITLE
Footwear	ASTM F1117-98, <i>Standard Specification for Dielectric Overshoe Footwear</i>
	ANSI Z41, <i>Standard for Personnel Protection - Protective Footwear</i>
Visual inspection	ASTM F1236-01, <i>Standard Guide for Visual Inspection of Electrical Protective Rubber Products</i>
Apparel	ASTM F1506-02a, <i>Standard Performance Specification for Flame Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers When Exposed to Momentary Electric Arc and Related Thermal Hazards</i>
Raingear	ASTM F 1891-02a, <i>Standard Specifications for Arc and Flame Resistant Rainwear</i>
Face protective products	ASTM F 2178-02, <i>Standard Test Method for Determining the Arc Rating of Face Protection Products</i>

Electric flash protection will be provided for any person who enters the flash protection zone. They must wear flame-resistant clothing and PPE, based on the incident exposure associated with the specific task. Refer to NFPA 70E for specific Hazard Risk Classifications and clothing/equipment requirements. ***Synthetic clothing such as acetate, nylon, polyester, rayon, either alone or in blends with cotton, are prohibited in the flash protection zone.***

- a. Employees must wear protective eye equipment whenever there is a danger from electric arcs, flashes, flying objects, or electrical explosion.
- b. Employees must wear flame-resistant clothing whenever they may be exposed to an electric flash. If used, flash suits and their closure design must permit easy and rapid removal. The entire flash suit, including the window, must have energy absorbing characteristics suitable for arc-flash-exposure. Use clothing and equipment to maximize worker protection. Clothing and equipment required by the degree of electrical hazard exposure can be worn alone or be integrated with normal apparel. Protective clothing and equipment must cover associated parts of the body and all normal apparel that is not flash-flame resistant, while allowing movement and visibility.
  - Employees must not wear synthetic materials that can melt next to skin.
- c. Employees must wear rubber-insulating gloves where there is a danger of hand or arm injury from electric shock or arc-flash burns due to contact with energized parts. Gloves made from layers of flame-resistant material provide the highest level of protection. Leather glove protectors should be worn over voltage-rated rubber gloves.
- d. Dielectric overshoes are required where electrically insulated footwear is used for protection against step and touch potential.
- e. NFPA 70E, Table 130.7(C)(9), 2004 should be used by a qualified person to determine the Hazard/Risk category associated with each task. Once the Hazard/Risk category has been determined, the qualified person will refer to NFPA 70E, Table 130.7(C)(10), 2004 to determine the requirements for protective clothing or other PPE.

An air test will be performed on electrical workers' rubber insulating gloves before each use.

Protective equipment of material other than rubber will provide equal or better electrical and mechanical protection.

Only live-line tool poles having a manufacturer's certification to withstand at least the following tests will be used:

- a. 100,000 volts per foot of length for 5 minutes when the tool is made of fiberglass, or
- b. 75,000 volts per foot of length for 3 minutes when the tool is made of wood, or
- c. Other equivalent tests.

Only tools and equipment intended for live-line bare hand work will be used on transmission lines. The tools will be kept dry and clean and will be visually inspected before use each day.

### **Demolition**

As part of total or partial building demolition, all utilities that could be affected must be identified and de-energized and as appropriate, disconnected at entry points to the building or building area to be demolished. Prior to actual demolition of enclosures, walls etc., electrical de-energizing must be verified by use of a tick tracer or similar device.

### **React to Contact with Electricity**

If a vehicle (or equipment carried on a vehicle) makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, the human body, if it simultaneously comes in contact with the vehicle or carrier and the ground, will provide a conductor of the electricity to the ground. Death or serious injury can be the result. If a vehicle or vehicle carrier makes contact with overhead or underground electrical lines:

- Under most circumstances, the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. Do not move or touch any part, particularly a metallic part, of the vehicle or equipment.
- If it is determined that the vehicle should be vacated, then all personnel should jump clear and as far as possible from the vehicle. Do not step off. Jump off. Do not hang on to the vehicle or equipment when jumping clear.
- If you are on the ground, you should stay away from the vehicle, do not let others get near the vehicle, and seek assistance from local emergency personnel such as the police or fire department.
- When an individual is injured and in contact with the vehicle or with power lines, only rescue with extreme caution. If a rescue is attempted, use a long, dry, unpainted piece of wood or a long, dry, clean rope. Keep as far away from the victim as possible and do not touch the victim until the victim is completely clear of the vehicle, equipment, or electrical lines.
- If the victim is unconscious and a heart beat (pulse) cannot be detected, cardiopulmonary resuscitation (CPR) should be begun immediately after the victim is completely clear of the electrical source.

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**INFORMATIONAL ADDENDUM**  
**16 JUNE 2010**

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# **Overview of Underground Utility Detection Methods**

## **Induction Utility Locators**

Induction utility locators operate by locating either a background signal or by locating a signal introduced into the utility line using a transmitter. There are three sources of background signals that can be located. A utility line can act like a radio antenna, transmitting electromagnetic signals that can be picked up with a receiver. AC power lines have a 50HZ signal associated with them. This signal occurs in all active AC power lines regardless of voltage. Utilities in close proximity to AC power lines or used as grounds may also have a 50HZ signal that can be located with a receiver. A signal can be indirectly induced onto a utility line by placing the transmitter above the line. Through a process of trial and error, the exact above position can be determined. A direct induced signal can be generated using an induction clamp. The inductor clamp induces a signal on specific utilities. This is the preferred method of tracing, where possible. By virtue of the closed loop, there is little chance of interference with the resulting signals. When access can be gained to a conduit, a flexible insulated trace wire can be used. The resulting signal loop can be traced. This is very useful for non-metallic conduits. Finally, these signals can be located horizontally on the surface using a receiver. The receiver is moved across the estimated location of the utility line until the highest signal strength is achieved. This is the approximate horizontal location of the utility. The receiver is then rotated until minimal signal strength is achieved. This will give the approximate orientation of the utility. Vertical depth, however, derived from this equipment is subject to gross error.

## **Magnetic Locators**

Ferrous Metal or Magnetic locators operate by indicating the relative amounts of buried ferrous metals. They have limited application to locating and identifying utility lines but can be very useful for locating underground storage tanks (UST's) and buried manhole covers or other subsurface objects with a large ferrous metal content.

## **Electromagnetic Surveys**

Electromagnetic survey equipment is used to locate metallic utilities. This method pulses the ground and records the signal retransmitted back to the unit from subsurface metal. Particularly useful for locating metal pipelines and conduit, this device also can help locate other subsurface objects such as UST's, buried foundations (that contain structural steel), and pilings and pile caps (that also contain steel).

## **Ground Penetrating Radar**

Ground Penetrating Radar (GPR) is an electromagnetic method that detects interfaces between subsurface materials with differing dielectric constants (a term that describes an electrical parameter of a material). The GPR system consists of an antenna, which houses the transmitter and receiver; and a profiling recorder, which processes the received signal and produces a graphic display of the data. The transmitter radiates repetitive short-duration EM signals into the earth from an antenna moving across the ground surface. Electromagnetic waves are reflected back to the receiver by interfaces between materials with differing dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant at the interface, the conductivity of the material, which the wave is traveling through, and the frequency of the signal. Subsurface features which may cause such reflections are: 1) natural geologic conditions such as changes in sediment composition, bedding and cementation horizons, voids, and water content; or 2) man-introduced materials or changes to the subsurface such as soil backfill, buried debris, tanks, pipelines, and utilities. The profiling recorder receives the signal from the antennae and produces a continuous cross section of the subsurface interface reflections, referred to as reflectors.

Depth of investigation of the GPR signal is highly site specific, and is limited by signal attenuation (absorption) of the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivity such as clays and brackish groundwater, and lowest in relatively low conductivity materials such as unsaturated sand or rock. Maximum depth of investigation is also dependent on antennae frequency and generally increases with decreasing frequency; however, the ability to identify smaller features is diminished as frequency decreases.

The various GPR antennas used are internally shielded from aboveground interference sources. Accordingly, the GPR signal is minimally affected by nearby aboveground conductive objects such as metal fences, overhead power lines, and vehicles.

A GPR survey is performed by towing an antenna across the ground along predetermined transect lines. The antennae is either pulled by a person or towed behind a vehicle. Preliminary GPR transects are performed over random areas of the site to calibrate the GPR equipment and characterize overall site conditions. The optimum time range settings are selected to provide the best combination of depth of investigation and data resolution for the subsurface conditions at the site. Ideally, the survey is performed along a pre-selected system of perpendicular or parallel transect lines. The configuration of the transect lines is designed based on the geometry and size of the target and the dimensions of the site. The beginning and ending points of the transect lines and grid intersection points, or nodes, are marked on the ground with spray paint or survey flags. A grid system is used to increase the probability of crossing the short axis of a target providing a more definitive signature in the data. The location of the antenna along a transect line is electronically marked on the cross section at each grid intersection point to allow correlation of the data to actual ground locations. The location of the targets can be marked on the ground surface using spray paint or survey flags.

### **Acoustic Location Methods**

Acoustic location methods generally apply to waterlines. A highly sensitive Acoustic Receiver listens for background sounds of water flowing; (at joints, leaks, etc.) or to sounds introduced into the water main using a transducer. This method may have good identification results, but can be inaccurate. Acoustics can also be utilized to determine the location of plastic gas lines.

## **RST 2 FLD 43A      ANIMALS**

Animals represent hazards because of their poisons or venoms, size and aggressiveness, diseases transmitted, or the insects they may carry.

### **Feral Animals**

Landfills and abandoned buildings often attract stray or abandoned dogs. These animals often become pack-oriented, very aggressive, and represent serious risk of harm to unprotected workers.

Workers entering abandoned buildings should be alert for such animals and avoid approaching them since this may provoke aggressive behavior. Avoidance and protection protocols include watching for animal dens, using good housekeeping, and using repellents.

### **Dangerous Wild Animals**

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This FLD outlines actions that, when properly implemented, should provide a high degree of protection for WESTON employees and wildlife.

See Wildlife Hazard Recognition and Protection Procedure (Attached).

### **Venomous Snakes and Lizards**

#### Venomous Snakes

Venomous snakes are common around the world. The major variables are the likelihood of encounter and the snake that is likely to be encountered. Encounters with snakes may be caused by moving containers, reaching into holes, or just walking through high grass, swampy areas, or rocks. **Do not attempt to catch any snakes.**

Symptom of venomous snake bites:

- Bloody wound discharge, blurred vision, burning, convulsions, diarrhea, dizziness, excessive sweating, fainting, fang marks in the skin, fever, increased thirst, local tissue death, loss of muscle coordination, nausea and vomiting, numbness and tingling, rapid pulse, severe pain, skin discoloration, swelling at the site of the bite, weakness.

Venom from venomous snakes and lizards can be divided into three types of toxins, however, there are some indications that snake venom may have more than one toxin and characteristics may change as a snake ages. The three types of toxins and their effects are:

**Hemotoxins** destroy blood cells and affect the circulatory system. The site of the bite rapidly becomes swollen, discolored, and painful. This is usually accompanied by swelling, discoloration, and pain progressing toward the heart.

**Neurotoxins** affect the nervous system and symptoms vary from foggy vision, dizziness, and other comparatively mild symptoms to rigid or flaccid paralysis, shortness of breath, weakness or paralysis of the lower limbs, double vision, inability to speak or swallow, drooping eyelids, and involuntary tremors of the facial muscles. Death can occur in as little as ten minutes, usually due to abrupt cessation of respiration.

**Myotoxins** destroy cells and cause muscle necrosis.

In the US, with the exception of the coral snakes which tend to have neuron-toxic venom, most venomous snakes have been categorized as having hemotoxic venom (in some areas Mojave rattlesnakes are found to have neuron-toxic venom). There is some indication that some species of rattlesnakes have both hemotoxic and neuron-toxic venom. It is also reported that venom of younger snakes may be more neuron-toxic

There are many highly venomous snakes worldwide, some are deadly and most can be deadly without proper care.

## **Geographical Listing of Venomous Snakes**

Following is a list of poisonous snakes by geographic area. This list is extensive but may not be all inclusive. In planning for work around the world, also contact local agencies to determine whether there may be additional venomous snakes or lizards.

### **North America**

**Copperheads** (Broad-banded, Northern, Osage, Southern, Trans-Pecos)

**Rattlesnakes** Diamondback (eastern and western), Massasauga (eastern and western)

**Cottonmouth or water moccasin** (Eastern)

### **Prevention of Bites**

Key factors to working safely in areas where snakes or lizards may be encountered include:

- Be alert
- Use care when reaching into or moving containers
- Use sticks or long-handled tools when reaching where you cannot see
- Be familiar with the habits and habitats of snakes in the vicinity of an incident or site
- In areas or activities where encounters with snakes are likely, wear sturdy leather or rubber work boots and snake chaps
- Do not attempt to catch snakes unless required and qualified

A snake bite warrants medical attention after administration of proper first-aid procedures. It is important to contact local medical facilities to determine where anti-venoms are located.

## **First-Aid**

1. Keep the person calm. Restrict movement, and keep the affected area below heart level to reduce the flow of venom.
2. Remove any rings or constricting items because the affected area may swell. Create a loose splint to help restrict movement of the area.
3. If the area of the bite begins to swell and change color, the snake was probably venomous.
4. Monitor the person's vital signs -- temperature, pulse, rate of breathing, and blood pressure if possible. If there are signs of shock (such as paleness), lay the person flat, raise the feet about a foot, and cover the person with a blanket.
5. Get medical help immediately.
6. Try to photograph or identify the snake. Do not waste time hunting for the snake, and do not risk another bite. Be careful of the head of a dead snake. A snake can actually bite for up to an hour after it is dead (from a reflex).
  - DO NOT allow the person to become over-exerted. If necessary, carry the person to safety.
  - DO NOT apply a tourniquet.
  - DO NOT apply cold compresses to a snake bite.
  - DO NOT cut into a snake bite with a knife or razor.
  - DO NOT try to suction the venom by mouth.
  - DO NOT give stimulants or pain medications unless instructed to do so by a doctor.
  - DO NOT give the person anything by mouth.
  - DO NOT raise the site of the bite above the level of the person's heart
  - Transport the victim to medical attention immediately

## **Animal Borne Diseases**

### **Rabies**

Animal borne diseases include rabies (generally found in dogs, skunks, raccoons, bats, and foxes). Rabies varies from area to area as do the animals most likely to be rabid.

### **Questions and Answers about Rabies**

*Q. What is Rabies and how is it transmitted?*

A. Rabies is a viral infection most often transmitted by bites of animals infected with the virus.

*Q. What animals are most likely to be infected?*

A. Skunks, raccoons, foxes, and bats are wild animals most frequently found to be infected with rabies; however, any warm blooded animal can be infected. Squirrels, groundhogs, horses, cattle, and rabbits have been tested positive for rabies. Dogs and cats are frequently rabies-infected if not immunized.

*Q. How can you tell if an animal is rabies-infected?*

A. Rabies infection is not always apparent. Signs to look for in wild animals are over-aggressiveness or passivity. Spotting animals which are normally nocturnal (active at night) during the day and being able to approach them would be an example of unusual behavior. Finding a bat alive and on the ground is abnormal. The best precaution, however, is to observe wild animals from a safe distance, even if they are injured. Avoid dogs and cats that you do not know.

*Q. What should you do if bitten by an animal you suspect is infected with rabies?*

A. As quickly as possible, wash the bite area with soap and water, then disinfect with 70% alcohol and seek medical attention for follow-up. Try to capture the animal. Avoid being bitten again or contacting the mouth or any saliva of the animal. Keep the animal under surveillance and call the police for assistance to capture it. Have the animal tested.

A dead animal believed to be infected should be preserved and tested for rabies. Health departments are often sources where information can be found regarding testing.

*Q. Is there a cure for rabies?*

A. Rabies is preventable, even after being bitten, if treatment is begun soon enough. Getting prompt medical attention and confirming the rabies infection of an animal are very important. **Rabies is not curable once symptoms or signs of rabies appear.**

There are vaccines available that should be considered if a work assignment involves trapping animals likely to carry rabies. Medical consultants must be involved in decisions to immunize workers against rabies.

## **Hantavirus**

WESTON employees or contractors/subcontractors conducting field work in areas where there is evidence of a rodent population should be aware of an increased level of concern regarding the transmission of “Hantavirus”-associated diseases. Hantavirus is associated with rodents, especially the deer mouse (*Peromyscus maniculans*) as a primary reservoir host. Hantavirus has resulted in several deaths in the U.S.

The Hantavirus can be transmitted by infected rodents through their saliva, urine, and feces. Human infection may occur when infected wastes are inhaled as a result of aerosols produced directly from the animals. They also may come from dried materials introduced into broken skin or onto mucous membranes. Infections in humans occur most in adults and are associated with

activities that provide contact with infected rodents in rural/semi-rural areas. Hantavirus begins with one or more flu-like symptoms (i.e., fever, muscle aches, headache, and/or cough) and progresses rapidly to severe lung disease. Early diagnosis and treatment are vital.

## **Prevention**

Personnel involved in work areas where rodents and the presence of the Hantavirus are known or suspected will need to take personal protective measures and to develop an expanded site safety plan.

Field personnel involved in trapping or contacting rodents or their waste products will need to wear respirators with high-efficiency particulate air (HEPA) filters, eye protection, Tyvek coveralls, chemical-resistant gloves, and disposable boot covers. Strict decontamination requirements are needed. Double-bag, label, and specific handling, packaging, shipping, storage, and analytical procedures are required to minimize the risks of exposure from collected mice. More detailed procedures can be obtained from WESTON Corporate Health and Safety.

For employees and facilities in rural/semi-rural areas, the following risk-reduction strategies are appropriate:

- Eliminate rodents and reduce availability of food sources and nesting sites used by rodents.
- Store trash/garbage in rodent-proof metal or thick plastic containers with tight lids.
- Cut all grass/underbrush in proximity to buildings.
- Prevent rodents from entering buildings (e.g., use steel wool, screen, etc., to eliminate openings).

## **Plague**

Described under Insects (Fleas)

## **Anthrax**

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in wild and domestic lower vertebrates (cattle, sheep, goats, and other herbivores), but it can also occur in humans when they are exposed to infected animals or tissue from infected animals.

Anthrax is most common in agricultural regions where it occurs in animals. When anthrax affects humans, it is usually due to an occupational exposure to infected animals or their products. Workers who are exposed to dead animals and animal products from other countries where anthrax is more common may become infected with *B. anthracis* (industrial anthrax). Anthrax in wild livestock has occurred in the U.S.

Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal. *B. anthracis* spores can live in the soil for many years, and humans can become infected with anthrax by handling products from infected animals or by inhaling anthrax spores from contaminated animal products. Anthrax can also be spread by eating undercooked meat from infected animals. It is rare to find infected animals in the U.S.

**Cutaneous:** Most (about 95%) anthrax infections occur when the bacterium enters a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather, or hair products (especially goat hair) of infected animals. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a vesicle and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black necrotic (dying) area in the center. Lymph glands in the adjacent area may swell. About 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy.

**Inhalation:** Initial symptoms may resemble a common cold. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax is usually fatal.

**Intestinal:** The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, and fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases.

Anthrax is not known to spread from one person to another person. Communicability is not a concern in managing or visiting patients with inhalation anthrax.

## **Prevention**

In countries where anthrax is common and vaccination levels of animal herds are low, humans should avoid contact with livestock and animal products and avoid eating meat that has not been properly slaughtered and cooked. Also, an anthrax vaccine has been licensed for use in humans. The vaccine is reported to be 93% effective in protecting against anthrax.

Doctors can prescribe effective antibiotics. To be effective, treatment should be initiated early. If left untreated, the disease can be fatal.

Direct person-to-person spread of anthrax is extremely unlikely; however, a patient's clothing and body may be contaminated with anthrax spores. Effective decontamination of people can be accomplished by a thorough wash down with anti-microbe effective soap and water. Waste water should be treated with bleach or other anti-microbial agent. Effective decontamination of articles can be accomplished by boiling contaminated articles in water for 30 minutes or longer and using common disinfectants. Chlorine is effective in destroying spores and vegetative cells on surfaces. Burning the clothing is also effective. After decontamination, there is no need to immunize, treat, or isolate contacts of people ill with anthrax unless they also were also exposed to the same source of infection. Early antibiotic treatment of anthrax is essential—delay seriously lessens chances for survival. Treatment for anthrax infection and other bacterial infections

includes large doses of intravenous and oral antibiotics, such as fluoroquinolones, like ciprofloxacin (cipro), doxycycline, erythromycin, vancomycin, or penicillin. In possible cases of inhalation anthrax exposure to unvaccinated personnel, early antibiotic prophylaxis treatment is crucial to prevent possible death.

No skin, especially if it has any wounds or scratches, should be exposed. Disposable personal protective equipment is preferable, but if not available, decontamination can be achieved by washing any exposed equipment in hot water, bleach and detergent. Disposable personal protective equipment and filters should be burned and buried. The size of *Bacillus anthracis* bacilli ranges from 0.5  $\mu\text{m}$  to 5.0  $\mu\text{m}$ . Anyone working with anthrax in a suspected or confirmed victim should wear respiratory equipment capable of filtering this size of particle or smaller. The U.S. National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA) approved high efficiency-respirator, such as a half-face disposable respirator with a HEPA filter, is recommended. All possibly contaminated bedding or clothing should be isolated in double plastic bags and treated as possible bio-hazard waste. Dead victims that are opened and not burned provide an ideal source of anthrax spores; the victim should be sealed in an airtight body bag. Cremating victims is the preferred way of handling body disposal. No embalming or autopsy should be attempted without a fully equipped biohazard lab and trained and knowledgeable personnel.

Delays of only a few days may make the disease untreatable and treatment should be started even without symptoms if possible contamination or exposure is suspected. Animals with anthrax often just die without any apparent symptoms. Initial symptoms may resemble a common cold – sore throat, mild fever, muscle aches and malaise. After a few days, the symptoms may progress to severe breathing problems and shock and ultimately death. Death can occur from about two days to a month after exposure with deaths apparently peaking at about 8 days after exposure. [8] Antibiotic-resistant strains of anthrax are known.

Aerial spores can be trapped by a simple HEPA or P100 filter. Inhalation of anthrax spores can be prevented with a full-face mask using appropriate filtration. Unbroken skin can be decontaminated by washing with simple soap and water. All of these procedures do not kill the spores which are very hard to kill and require extensive treatment to eradicate them. Filters, clothes, etc. exposed to possible anthrax contaminated environments should be treated with chemicals or destroyed by fire to minimize the possibility of spreading the contamination.

In recent years there have been many attempts to develop new drugs against anthrax; but the existing supply still works fine if treatment is started soon enough.

Prevention can also be accomplished through early detection. In response to the U.S. Postal Service (USPS) anthrax attacks of October 2001, the USPS has installed BioDetection Systems (BDS) in their large-scale mail cancellation facilities. BDS response plans have been formulated by the USPS in conjunction with local responders including fire, police, hospitals, and public health. Employees of these facilities have been educated about anthrax, response actions and prophylactic medication. Because of the time delay inherent in getting final verification that anthrax has been used, prophylactic antibiotics for possibly exposed personnel should commence as soon as possible.

The ultimate in prevention is vaccination against infection but this has to be done well in advance of exposure.

Anthrax spores can survive for long periods of time in the environment after release. Methods for cleaning anthrax contaminated sites commonly use oxidizing agents such as peroxides, ethylene Oxide, Sandia Foam, chlorine dioxide (used in the Hart Senate office building), and liquid bleach products containing sodium hypochlorite. These agents slowly destroy bacterial spores. A bleach solution for treating hard surfaces has been approved by the EPA and can be prepared by mixing one part bleach (5.25%-6.00%) to one part white vinegar to eight parts water. Bleach and vinegar must not be combined together directly, rather some water must first be added to the bleach (e.g., two cups water to one cup of bleach), then vinegar (e.g., one cup), and then the rest of the water (e.g., six cups). The pH of the solution should be tested with a paper test strip; and treated surfaces must remain in contact with the bleach solution for 60 minutes (repeated applications will be necessary to keep the surfaces wet).

Chlorine dioxide has emerged as the preferred biocide against anthrax-contaminated sites, having been employed in the treatment of numerous government buildings over the past decade. Its chief drawback is the need for in situ processes to have the reactant on demand.

To speed the process, trace amounts of a non-toxic catalyst composed of iron and tetra-amido macrocyclic ligands are combined with sodium carbonate and bicarbonate and converted into a spray. The spray formula is applied to an infested area and is followed by another spray containing tertiary-butyl hydroperoxide

Using the catalyst method, a complete destruction of all anthrax spores takes 30 minutes. A standard catalyst-free spray destroys fewer than half the spores in the same amount of time. They can be heated, exposed to the harshest chemicals, and they do not easily die.

## **Brucellosis**

Brucellosis, also called undulant fever or Malta fever, is a zoonosis (infectious disease transmitted from animals to humans) caused by bacteria of the genus *Brucella*. It is primarily a disease of domestic animals (goats, pigs, cattle, dogs, etc.) and humans and has a worldwide distribution.

Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animal health programs. Areas currently listed as high risk include the Caribbean.

The disease is transmitted either through contaminated or untreated milk (and its derivatives) or through direct contact with infected animals, which may include dogs, pigs, camels, and ruminants, primarily sheep, goats, cattle, and bison. This also includes contact with their carcasses.

Leftovers from parturition are also extremely rich in highly virulent brucellae. Brucellae, along with leptospira have the unique property of being able to penetrate through intact human skin, so infection by mere hand contact with infectious material is likely to occur.

The disease is now usually associated with the consumption of un-pasteurized milk and soft cheeses made from the milk of infected animals and with occupational exposure of veterinarians and slaughterhouse workers. Some vaccines used in livestock, most notably *B. abortus* strain 19 also cause disease in humans if accidentally injected. Problems with vaccine induced cases in the United States declined after the release of the RB-51 strain developed in the 1990s and the relaxation of laws requiring vaccination of cattle in many states.

The incubation period of brucellosis is, usually, of one to three weeks, but some rare instances may take several months to surface.

Brucellosis induces inconstant fevers, sweating, weakness, anemia, headaches, depression and muscular and bodily pain.

The symptoms are like those associated with many other febrile diseases, but with emphasis on muscular pain and sweating. The duration of the disease can vary from a few weeks to many months or even years. In first stage of the disease, septicaemia occurs and leads to the classic triad of undulant fevers, sweating (often with characteristic smell, likened to wet hay) and migratory arthralgia and myalgia.

## **Prevention**

The main way of preventing brucellosis is by using fastidious hygiene in producing raw milk products, or by pasteurization of all milk that is to be ingested by human beings, either in its pure form or as a derivate, such as cheese.

Provide protection from skin contact when handling potentially infected animals.

## **Q fever**

**Q fever** is caused by infection with *Coxiella burnetii*. This organism is uncommon but may be found in cattle, sheep, goats and other domestic mammals, including cats and dogs. The infection results from inhalation of contaminated particles in the air, and from contact with the vaginal mucus, milk, feces, urine or semen of infected animals. The incubation period is 9-40 days. It is considered possibly the most infectious disease in the world, as a human being can be infected by a single bacterium.

The most common manifestation is flu-like symptoms with abrupt onset of fever, malaise, profuse perspiration, severe headache, myalgia (muscle pain), joint pain, loss of appetite, upper respiratory problems, dry cough, pleuritic pain, chills, confusion and gastro-intestinal symptoms such as nausea, vomiting and diarrhea. The fever lasts approximately 7-14 days.

During the course, the disease can progress to an atypical pneumonia, which can result in a life threatening acute respiratory distress syndrome (ARDS), whereby such symptoms usually occur during the first 4-5 days of infection.

Less often the Q fever causes (granulomatous) hepatitis which becomes symptomatic with malaise, fever, liver enlargement (hepatomegaly), pain in the right upper quadrant of the abdomen and jaundice (icterus).

The chronic form of the Q fever is virtually identical with the inflammation of the inner lining of the heart (endocarditis), which can occur after months or decades following the infection. It is usually deadly if untreated. However, with appropriate treatment this lethality is around 10%.

The common way of infection is inhalation of contaminated dust, contact with contaminated milk, meat, wool and particularly birthing products. Ticks can transfer the pathogenic agent to other animals. Transfer between humans seems extremely rare and has so far been described in very few cases.

### **Prevention**

Q fever is effectively prevented by intradermal vaccination with a vaccine composed of killed *Coxiella burnetii* organisms. Skin and blood tests should be done before vaccination to identify preexisting immunity; the reason is that vaccinating subjects who already have immunity can result in a severe local reaction. After a single dose of vaccine, protective immunity lasts for many years. Revaccination is not generally required. Annual screening is typically recommended.

Wear appropriate PPE when handling potentially infected animals or materials.

### **Leptospirosis**

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*.

The time between a person's exposure to a contaminated source and becoming sick is 2 days to 4 weeks. Illness usually begins abruptly with fever and other symptoms. Leptospirosis may occur in two phases; after the first phase, with fever, chills, headache, muscle aches, vomiting, or diarrhea, the patient may recover for a time but become ill again. If a second phase occurs, it is more severe; the person may have kidney or liver failure or meningitis. This phase is also called Weil's disease.

The illness lasts from a few days to 3 weeks or longer. Without treatment, recovery may take several months. In rare cases death occurs.

Many of these symptoms can be mistaken for other diseases. Leptospirosis is confirmed by laboratory testing of a blood or urine sample.

*Leptospira* organisms have been found in cattle, pigs, horses, dogs, rodents, and wild animals. Humans become infected through contact with water, food, or soil containing waste from these infected animals. This may happen by consuming contaminated food or water or through skin contact, especially with mucosal surfaces, such as the eyes or nose, or with broken skin. The disease is not known to be spread from person to person.

Leptospirosis occurs worldwide but is most common in temperate or tropical climates. It is an occupational hazard for many people who work outdoors or with animals, for example, farmers, sewer workers, veterinarians, fish workers, dairy farmers, or military personnel. It is a recreational hazard for campers or those who participate in outdoor sports in contaminated areas and has been associated with swimming, wading, and whitewater rafting in contaminated lakes and rivers. The incidence is also increasing among urban children.

The risk of acquiring leptospirosis can be greatly reduced by not swimming or wading in water that might be contaminated with animal urine.

Protective clothing or footwear should be worn by those exposed to contaminated water or soil because of their job or recreational activities.

## **Prevention**

Avoid risky foods and drinks.

Buy it bottled or bring it to a rolling boil for 1 minute before drink it. Bottled carbonated water is safer than non-carbonated water.

Ask for drinks without ice unless the ice is made from bottled or boiled water. Avoid popsicles and flavored ices that may have been made with contaminated water.

Eat foods that have been thoroughly cooked and that are still hot and steaming

Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to wash well. When eating raw fruit or vegetables that can be peeled, peel them yourself. (Wash your hands with soap first.) Do not eat the peelings.

Avoid foods and beverages from street vendors. It is difficult for food to be kept clean on the street, and many travelers get sick from food bought from street vendors.

Leptospirosis is treated with antibiotics, such as doxycycline or penicillin, which should be given early in the course of the disease. Intravenous antibiotics may be required for persons with more severe symptoms. Persons with symptoms suggestive of leptospirosis should contact a health care provider.

## **Ebola**

Ebola is both the common term used to describe a group of viruses belonging to genus Ebolavirus, family Filoviridae, and the common name for the disease which they cause, Ebola hemorrhagic fever. Ebola viruses are morphologically similar to the Marburg virus, also in the family Filoviridae, and share similar disease symptoms. Ebola has caused a number of serious and highly publicized outbreaks since its discovery.

Despite considerable effort by the World Health Organization, no animal reservoir capable of sustaining the virus between outbreaks has been identified. However, it has been hypothesized that the most likely candidate is the fruit bat.

Ebola hemorrhagic fever is potentially lethal and encompasses a range of symptoms including fever, vomiting, diarrhea, generalized pain or malaise, and sometimes internal and external bleeding. Mortality rates are extremely high, with the human case-fatality rate ranging from 50% - 89%, according to viral subtype. <sup>[2]</sup> The cause of death is usually due to hypovolemic shock or organ failure.

Because Ebola is potentially lethal and since no approved vaccine or treatment is available, Ebola is classified as a biosafety level 4 agent, as well as a Category A bioterrorism agent by the Centers for Disease Control and Prevention.

Symptoms are varied and often appear suddenly. Initial symptoms include high fever (at least 38.8°C), severe headache, muscle joint, or abdominal pain, severe weakness and exhaustion, sore throat, nausea, and dizziness. Before an outbreak is suspected, these early symptoms are easily mistaken for malaria, typhoid fever, dysentery, influenza, or various bacterial infections, which are all far more common and less reliably fatal.

Ebola may progress to cause more serious symptoms, such as diarrhea, dark or bloody feces, vomiting blood, red eyes due to distention and hemorrhage of sclerotic arterioles, petechia, maculopapular rash, and purpura. Other secondary symptoms include hypotension (less than 90 mm Hg systolic /60 mm Hg diastolic), hypovolemia, tachycardia, organ damage (especially the kidneys, spleen, and liver) as a result of disseminated systemic necrosis, and proteinuria. The interior bleeding is caused by a chemical reaction between the virus and the platelets which creates a chemical that will cut cell sized holes into the capillary walls.

Among humans, the virus is transmitted by direct contact with infected body fluids, or to a lesser extent, skin or mucus membrane contact. The incubation period can be anywhere from 2 to 21 days, but is generally between 5 and 10 days.

Although airborne transmission between monkeys has been demonstrated by an accidental outbreak in a laboratory located in Virginia, USA, there is very limited evidence for human-to-human airborne transmission in any reported epidemics.

The infection of human cases with Ebola virus has been documented through the handling of infected chimpanzees, and gorillas--both dead and alive.

So far, all epidemics of Ebola have occurred in sub-optimal hospital conditions, where practices of basic hygiene and sanitation are often either luxuries or unknown to caretakers and where disposable needles and autoclaves are unavailable or too expensive. In modern hospitals with disposable needles and knowledge of basic hygiene and barrier nursing techniques, Ebola rarely spreads on such a large scale.

## **Prevention**

Prevention methods include good hygiene in medical settings and awareness of the virus in travel areas. There is no known effective vaccine for humans.

Prevention efforts should concentrate on avoiding contact with host or vector species. Travelers should not visit locations where an outbreak is occurring. Contact with rodents should be avoided. Minimize exposure to arthropod bites by using permethrin-impregnated bed nets and insect repellents.

Strict compliance with infection control precautions (i.e., use of disposable gloves, face shields, and disposable gowns to prevent direct contact with body fluids and splashes to mucous membranes when caring for patients or handling clinical specimens; appropriate use and disposal of sharp instruments; hand washing and use of disinfectants) is recommended to avoid health care-associated infections.

Contact with dead primates should be avoided.

## **Bird and Bat Borne or Enhanced Diseases**

**See also under Molds and Fungus**

## **Histoplasmosis**

Histoplasmosis is a fungal infection which enters the body through the lungs. The infection enters the body through the lungs. The fungus grows as a mold in the soil, and infection results from breathing in airborne particles. Soil contaminated with bird or bat droppings are known to have a higher concentration of histoplasmosis.

There may be a short period of active infection, or it can become chronic and spread throughout the body. Most people who do develop symptoms will have a flu-like syndrome (acute-fever, chills cough, and chest pain; chronic-chest pain, cough with blood, fever, shortness of breath, sweating) and lung complaints related to pneumonia or other lung involvement. Approximately 10% of the population will develop inflammation in response to the initial infection. This can affect the skin, bones or joints, or the lining of the heart (pericardium). These symptoms are not due to fungal infection of those body parts, but due to inflammation.

In a small number of patients, histoplasmosis may become widespread (disseminated) and involve the blood, brain, adrenal glands, or other organs. Very young or old are at a higher risk for

disseminated histoplasmosis. Symptoms include fevers, headache, neck stiffness, mouth sores, skin lesions.

Histoplasmosis may be prevented by reducing dust exposure in areas containing bird or bat droppings. Wear PPE and respirator when working within this environment. Institute work practices and dust control measures, i.e. moist/wet area, that eliminate or reduce dust generation which will reduce risks of infection and subsequent development of disease.

## Treatment

The main treatment for histoplasmosis is antifungal drugs. Amphotericin B, itraconazole, and ketoconazole are the usual treatments. Long-term treatment with antifungal drugs may be needed.

## Psittacosis

Psittacosis is a disease caused by a bacteria that is found in bird droppings and other secretions (often carried by pet birds). The bacteria is found worldwide.

Symptoms of psittacosis infection may include a low-grade fever that often becomes worse as the disease progresses, including anorexia, sore throat, light sensitivity, and a severe headache.

Ammonia and sodium hypochlorite based disinfectants are effective disinfectants for Psittacosis.

Where it is necessary to remove bat droppings from buildings prior to renovation or demolition it is prudent to assume infection and use the following precautions:

- Avoid areas that may harbor the bacteria, e.g., accumulations of bird or bat droppings.
- Areas known or suspected of being contaminated by *the organisms causing* Psittacosis such as bird roosts, attics, or even entire buildings that contain accumulations of bat or bird manure, should be posted with signs warning of the health risk. The building or area should be secured
- Before an activity is started that may disturb any material that might be contaminated by Psittacosis, workers should be informed in writing of the personal risk factors that increase an individual's chances of developing these diseases. Such a written communication should include a warning that individuals with weakened immune systems are at the greatest risk of developing severe forms of these diseases become infected. These people should seek advice from their health care provider about whether they should avoid exposure to materials that might be contaminated with these organisms.

The best way to prevent exposure is to avoid situations where material that might be contaminated can become aerosolized and subsequently inhaled. A brief inhalation exposure to

highly contaminated dust may be all that is needed to cause infection and subsequent development of psittacosis. Therefore, work practices and dust control measures that eliminate or reduce dust generation during the removal of bat manure from a building will also reduce risks of infection and subsequent development of disease. For example, instead of shoveling or sweeping dry, dusty material, carefully wetting it with a water spray can reduce the amount of dust aerosolized during an activity. Adding a surfactant or wetting agent to the water might reduce further the amount of aerosolized dust.

Once the material is wetted, it can be collected in double, heavy-duty plastic bags, a 55-gallon drum, or some other secure container for immediate disposal. An alternative method is use of an industrial vacuum cleaner with a high-efficiency filter to *bag* contaminated material. Truck-mounted or trailer-mounted vacuum systems are recommended for buildings with large accumulations of bat or bird manure. These high-volume systems can remove tons of contaminated material in a short period. Using long, large-diameter hoses, such a system can also remove contaminated material located several stories above its waste hopper. This advantage eliminates the risk of dust exposure that can happen when bags tear accidentally or containers break during their transfer to the ground.

The removal of all material that might be contaminated from a building and immediate waste disposal will eliminate any further risk that someone might be exposed to aerosolized spores. Air sampling, surface sampling, or the use of any other method intended to confirm that no infectious agents remain following removal of bat manure is unnecessary in most cases. However, before a removal activity is considered finished, the cleaned area should be inspected visually to ensure that no residual dust or debris remains.

Spraying 1:10 bleach to water mixture on droppings and allowing it to dry is also a recommended practice for the psittacosis organisms.

Because work practices and dust control measures to reduce worker exposures to these organisms have not been fully evaluated, using personal protective equipment is still necessary during some activities. During removal of an accumulation of bat or bird manure from an enclosed area such as an attic, dust control measures should be used, but wearing a NIOSH-approved respirator and other items of personal protective equipment is also recommended to reduce further the risk of exposure to the organisms that cause Psittacosis.

## Treatment

Psittacosis is often hard to diagnoses and while a concern, it does not occur with great frequency. Knowledge of the symptoms and of potential exposure is important when seeking medical follow-up for potential exposure.

There are various medical treatments for psittacosis based on extent of infection. The sooner the disease is diagnosed and treatment is begun the more effective the treatment will be.

## **APPENDIX A**

### **Dangerous Animals - Wildlife Hazard Recognition and Protection**

#### **GENERAL**

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This procedure outlines actions that when properly implemented should provide a high degree of protection for employees and wildlife.

These procedures apply to employees who prepare Health and Safety Plans or perform fieldwork in environments in which wild animals may be encountered. However, due to the unpredictable nature of wild animals this single document cannot possibly cover all potential risks or protective measures. Therefore, prior to entering remote areas inhabited by dangerous wildlife, contact local wildlife agencies to gather additional information concerning local risks and protective measures.

#### **ATTACHMENTS**

Attachments 1 and 2 outline behavioral characteristics of and outline controls that will minimize human injury, loss of property, and unnecessary destruction of wildlife, while ensuring a safe work environment.

#### **WILDLIFE AVOIDANCE AND BASIC PROTECTIVE MEASURES**

The best protective measure is simply avoidance. Large numbers of humans present deterrence to wild animals; therefore, whenever possible teams in the field should work together in groups of four or more. Whenever practical, fieldwork should be scheduled around the seasonal cycles of wildlife in the area. When wild animal avoidance cannot be achieved through scheduling, personnel involved in field activities in which encounters with wild animals may result, will take the following steps and will be equipped and trained, as set forth below.

#### **CLEAR THE AREA**

Evaluate and control the area before entry by

- Determine areas of recent sightings through local Fish and Game, state troopers, etc.;
- Conduct a site observation from an off-site elevated point, if possible;
- Conduct a controlled walk through in the area by a trained observer;
- Arrange a briefing by a local specialist, e. g., Fish and Game, etc.; and
- Utilizing appropriate noisemakers.

#### **BASIC EQUIPMENT**

Employees entering an environment where encounters with wild animals are possible should be provided, as a minimum:

- Noisemakers, such as air horns, bells, etc.; and
- Bear spray of not less than 16-ounce capacity (with holster), equivalent to capsicum pepper (red pepper extract), which is capable of spraying at least 15 feet. (Notes: Normally cannot be transported in side aircraft passenger compartments and may be

considered a hazardous material, check with airlines and hazardous material shippers for current information).

## **TRAINING**

Prior to entering and / or working in areas inhabited by dangerous wildlife each employee should receive training as outlined in this procedure. At a minimum, training must include information related to:

- Wildlife present, habitat, behavior patterns, including when wild animals are most active, etc.
- Warning signs, such as tracks, bedding areas, scat, claw marks, offspring, paths, etc.,
- Avoidance measures
- Other hazards, precautions, and protective measures as outlined in the Attachments,
- (At the jobsite) spray demonstration and safety instructions which include location of and persons designated as “bear watch”

An outline of the training content should be reviewed and approved by the Divisional EHS manager and should be documented. A record of the training will be maintained at the job site, filed with the SSHSP and in the employee’s training records.

## **VEHICLE SAFETY**

Use extreme caution, particularly in darkness, when operating vehicles in areas where wild animals may be present. Collisions with large animals have been known to cause significant property damage and personal injuries to vehicle passengers, including fatalities.

## **ATTACHMENT 1**

### **BEAR SAFETY – HAZARD RECOGNITION AND PRECAUTIONS**

On occasion fieldwork may be conducted in a location where bears may be encountered. The following technical information, precautions, and guidelines for operations in which bears could be encountered are based on experience and conditions for field work. Bears are intelligent, wild animals and are potentially dangerous, and would rather be left alone. The more bears are understood the less they will be feared. This attachment is intended to provide information that will enable Weston to plan for bear encounters and to properly address face-to-face encounters.

### **Bear Life History**

Although bears are creatures of habit, they are also intelligent, and each has its own personality. The way a bear reacts is often dictated by what it has learned from its mother, the experience it has had on its own, and the instincts nature has provided. Like other intelligent animals, we can make general statements about bears, but few people can accurately predict their behavior.

Bears have an incredible sense of smell, and seem to trust it more than any other sense. Hearing and sight are also important, but to a lesser degree. A bear's hearing is probably better than ours, but not as keen as a dog's hearing. Their sight is probably comparable to that of a human. Black bears tend to favor forested habitats.

Bears are opportunists, relying on their intelligence and their senses to find food. They use different habitats throughout the year, depending on the availability of food and other necessities. The area a bear covers in a given year is partially dependent on how far it has to go to satisfy these basic needs. In some areas, individual bears have home ranges of less than a square mile; in other areas ranges can encompass hundreds of square miles. Males usually range over larger areas than females.

In spring, bears begin coming out of hibernation. Males are usually the first bears to emerge, usually in April, and females with new cubs are usually the last, sometimes as late as late June. When bears emerge from their dens, they are lethargic for the first few days, frequently sleeping near their dens and not eating. When they do start eating, they seek carrion (deer, etc.), roots, and emerging vegetation. In coastal areas, beaches become travel corridors as bears seek these foods.

In early summer, bears eat new grasses and forage as they develop in higher elevations. In coastal areas, salmon are the most important food from June through September. This period is one of the few times that bears are found in large groups, and it is the time that most people see bears. Bears often travel, eat, and sleep along streams for weeks at a time.

Other summer foods for bears include grasses and ground squirrels. When bears kill or scavenge large prey, they commonly cover the portions they cannot eat with sticks and duff. A bear may remain near a food cache for days and it will defend it from intruders.

During the late summer and early fall, bears move inland and consume large amounts of blueberries, and other succulent fruits. As the seasons progress towards winter, a bear's diet becomes more varied. This is the time that bears are adding final deposits of fat before their long winter naps.

In October and November, bears move into their denning areas and begin preparing a suitable den. Black bears usually den in holes under large trees or rock outcrops, or in small natural cavities. Dens are just large enough for the bears to squeeze into. Bears rarely eat, drink, urinate, or defecate while they are denning. They sleep deeply, but do not truly hibernate, and they can be awakened by loud noises or disturbances.

Cubs are born in the den, usually in January. Black bear cubs usually stay with their mothers for a year and a half. Black bears are sexually mature at age 2. Mating season is in the spring (May or June) and both species are polygamous (multiple mates). Black bears can live for 25 – 30 years, although most live less than 20 years.

### **BEAR AND HUMAN INTERACTIONS**

Bears generally prefer to be left alone, but they share their homes with other creatures, including humans, who intrude on virtually every aspect of the bear's life. Bears are normally tolerant of these activities and generally find a secure way to avoid them. Humans can help bears make a graceful retreat and avoid many close encounters by letting them know we are coming. Walking in groups, talking, and wearing noise making devices, such as bear bells, all serve to warn a bear of your approach. When possible, avoid hiking and camping in areas where bears are common, such as bear trails through heavy brush or along salmon streams. Always keep an eye out for bears and bear signs. If you happen upon a dead animal, especially one that is covered with sticks and duff (a bear cache), immediately retreat the way you came, but do not run, and make a detour around the area. If you see a cub up a tree or a small bear walking alone, immediately retreat and detour around the area. Like all young animals, cubs wander away from their mothers, but females are furiously protective when they believe their cubs are threatened. Even if we do everything possible to avoid meeting a bear, sometimes bears come to us.

Bears are both intelligent and opportunistic, and they express these qualities through their curiosity. This curiosity frequently brings them into "human habitat." When this happens, we often feel vulnerable, and the bear is sometimes viewed as a threat or nuisance. In most cases, a curious bear will investigate a "human sign," perhaps test it out (chew on a raft, bite into some cans, etc.), and leave, never to return. If the bear was rewarded during his investigation by finding something to eat, it is hard to stop them from returning once they have had a food-reward. That is why we emphasize the importance of keeping human food and garbage away from bears. When in bear country, always think about the way you store, cook, and dispose of your food. **Never feed bears!** This is both illegal and foolish. Food should be stored in airtight containers, preferably away from living and sleeping areas. Garbage should be thoroughly incinerated as soon as possible. Fish and game should be cleaned well away from camp, and clothing that smells of fish and game should be stored away from sleeping areas. Menstruating women should take extra precautions to keep themselves as clean as possible, and soiled tampons and pads should

be treated as another form of organic garbage. Once a bear has obtained food from people, it may continue to frequent areas occupied by people. If a bear does not find food or garbage after the next few tries, it may give up and move back into a more natural feeding pattern. Occasionally, though, the bear will continue to seek human foods and can become a “problem bear.” Some bears become bold enough to raid campsites and break into cabins to search for human food. Shooting bears in the rump with cracker shells, flares, rubber bullets, and birdshot are common methods of “aversive conditioning.” These are also very dangerous techniques, because they may seriously injure a bear if not done properly and/or they may cause a bear to attack the shooter.

## **BLACK BEARS**

Black Bear Identification: Black bears are the smallest and most abundant of the bear species. They are five to six feet long and stand about two to three feet high at the shoulders. They weigh from 200 to 500 pounds. While they are most commonly black, other color phases include brown (cinnamon), and, rarely, gray (blue), and white. Muzzles are usually brown. Black bears can be distinguished from brown bears by:

- Their head shape (a black bear’s nose is straight in profile, a brown bear’s is dished);
- Their claws (black bear’s claws are curved and smaller, brown bears are relatively straight and longer);
- Their body shape (when standing, a black bear’s rump seems to be higher than its shoulders; a brown bear’s shoulders are usually higher than its rump); and

Typical Habitat: Black bears occupy a wide range of habitats, but seem to be most common in forested areas.

## **AVOIDING BEAR ENCOUNTERS WHEN**

- The Bear sees you but you do not know the bear is around: The bear will likely avoid detection people and will simply move away when they sense a human.
- You see a bear and it does not know you are there: Move away slowly. Avoid intercepting the bear if it is walking. If possible, detour around the bear. If the bear is close to you, stand where you are or back away slowly. Do not act threateningly toward the bear, it may know you are there but it has chosen to ignore you as long as you are not a threat.
- You see the bear and the bear sees you: Do not act threateningly, but let the bear know you are human. Wave your arms slowly, talk in a calm voice, and walk away slowly in a lateral direction, keeping an eye on the bear. Unless you are very close to a car or a building, never run from bears. In a bear’s world, when something runs it is an open invitation to chase it. Bears will chase a running object even if they have no previous intention of catching it. Bears can run as fast as a racehorse, so humans have little or no chance of outrunning a bear.
- You see a bear; the bear sees you and stands on its hind legs: This means that the bear is seeking more information. Bears stand on their hind legs to get a better look, or smell, at something they are uncertain of. It is your cue to help it figure

out what you are. Help the bear by waving your arms slowly and talking to it. Standing is not a precursor to an attack. Bears do not attack on their hind legs. It is also important to remember that when a bear goes back down on all fours from a standing position, it may come towards you a few steps. This is normal, and probably not an aggressive act.

- The bear sees you, recognizes you as a human, but continues to come towards you slowly: This may mean several things, depending on the bear and the situation. It may mean that the bear does not see you as a threat, and just wants to get by you (especially if the bear is used to humans, as in a National Park); the bear wants to get food from you (if it has gotten food from people before); the bear wants to test your dominance (it views you as another bear); or may be stalking you as food (more common with black bear, but a rare occurrence). In all cases, your reaction should be to back off the trail very slowly, stand abreast if you are in a group, talk loudly, and/or use a noise-making device. If the bear continues to advance, you should stop. At this point, it is important to give the bear the message that if he continues to advance it will cost him. Continue to make loud noises and present a large visual image to the bear (standing abreast, open your coat). In bear language, bears assert themselves by showing their size. If an adult brown bear continues to come at you, climbing 20 feet or higher up a tree may also be an option if one is next to you (remember, never run from bears). Keep in mind, though, black bears can climb trees.
- The bear recognizes you as a human and acts nervous or aggressive: When bears are nervous or stressed they can be extremely dangerous. This is when it is important to try to understand what is going on in the bears mind. Nervous bears growl, woof, make popping sounds with their teeth, rock back and forth on their front legs, and often stand sideways to their opponent. A universal sign of a nervous bear is excessive salivation (sometimes it looks like they have white lips). When a bear shows any of these signs, stand where you are and talk in a calm voice. Do not try to imitate bear sounds, this may only serve to confuse and further agitate the bear. If you are in a group, stand abreast.
- The bear charges: If all other signals fail, a bear will charge. Surprisingly, most bear charges are just another form of their language. The majority of these are “bluff charges,” that is; the bear stops before making contact with their opponent. There are many different types of bluff charges ranging from a loping uncertain gait to a full-blown charge. If a bear charges, stand still.
- The bear attacks: When all else fails, a bear may attack. Attacks may be preceded by all of the behaviors previously described or they may be sudden. Seemingly unprovoked attacks are often the result of a bear being surprised (and feeling threatened), a bear defending its food cache, or a female defending her cubs. When a bear attacks, it typically runs with its body low to the ground, legs are stiff, ears are flattened, hair on the nape of the neck is up, and the bear moves in a fast, determined way. Front paws are often used to knock the opponent down and jaws are used to subdue it.

## **AFTER A BEAR ENCOUNTER**

Black bears have been known to view humans as prey, and if you struggle with the attacking black bear, it will probably go elsewhere for its meal.

- Bear Sprays: Are easy to carry and use, little risk of permanent damage to bears and humans, effective in many situations. However, using a spray may change a false charge into a real charge, they are ineffective at ranges greater than 20 feet, ineffective in windy conditions, dangerous if accidentally discharged in a closed area such as an aircraft cockpit.

The most effective tool you have against an attacking bear is your brain. Although bears are intelligent animals, we are smarter and can often think our way out of a bad situation if we try.

## **ATTACHMENT 2**

### **HAZARDS AND PRECAUTIONS – DEER**

The following technical information, precautions, and guidelines for operations in which Deer may be encountered. The more the species are understood, the easier it will be to avoid contact with them thus preventing injury to ourselves and to the animals. All big game species are unpredictable and can be dangerous under certain conditions. This attachment is intended to provide information that will enable Weston to plan for encounters and to properly address face-to-face encounters.

### **WHITE-TAILED DEER**

The White-tailed deer found throughout the eastern and western part of the United States have been known to attack people on many occasions. It is unknown whether Black-tailed deer have made any such attacks, but it is possible for someone to be injured by an irate buck in the breeding season (late fall). Deer are well equipped to injure humans. They are very fast. Bucks have sharp antlers and can clear amazingly high obstacles with graceful, arching leaps. They can run with remarkable speed, even in dense cover, and have excellent camouflage. When working in areas populated with deer, it is just common sense not to approach any large wild animal too closely. It is unlikely that an attack from a deer would be fatal but it is possible and serious injury is likely.

## APPENDIX B - PICTURES OF POISONOUS SNAKES AND LIZARDS

### Americas



American copperhead



Cotton Mouth – East and Southeast US



Timber Rattlesnake – Eastern US



## **FLD 43 B     INSECTS**

### **Sting and Biting Insects**

Contact with stinging insects may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. These include the following:

- Bees (Honeybees, bumble bees, wasps, and hornets and wingless wasps)
- Scorpions
- Fire ants
- Spiders
- Ticks
- Deer Flies
- Mosquito
- Fleas
- Bed Bugs

### **Bees, Wasps, Hornets and Yellow Jackets**

The severity of an insect sting reaction varies from person to person. A normal reaction will result in pain, swelling and redness confined to the sting site. Simply disinfect the area (washing with soap and water will do) and apply ice to reduce the swelling.

A large local reaction will result in swelling that extends beyond the sting site. For example, a sting on the forearm could result in the entire arm swelling twice its normal size.

Although alarming in appearance, this condition is often treated the same as a normal reaction. An unusually painful or very large local reaction may need medical attention. Because this condition may persist for two to three days, antihistamines and corticosteroids are sometimes prescribed to lessen the discomfort.

Yellow jackets, hornets and wasps can sting repeatedly. Honeybees have barbed stingers that are left behind in their victim's skin. These stingers are best removed by a scraping action, rather than a pulling motion, which may actually squeeze more venom into the skin.

### **Scorpions (Caribbean)**

Scorpion stings are a major public health problem in many underdeveloped tropical countries. For every person killed by a poisonous snake, 10 are killed by a poisonous scorpion. In the United States, only 4 deaths in 11 years have occurred as a result of scorpion stings. Furthermore, scorpions can be found outside their normal range of distribution, ie, when they

accidentally crawl into luggage, boxes, containers, or shoes and are unwittingly transported home via human travelers.

Out of 1,500 scorpion species, 50 are dangerous to humans. Scorpion stings cause a wide range of conditions, from severe local skin reactions to neurologic, respiratory, and cardiovascular collapse.

Almost all of these lethal scorpions belong to the scorpion family called the Buthidae. The Buthidae are small to mid-size scorpions (0.8 inch to 5.0 inches) and normally uniformly colored without patterns or shapes. Poisonous scorpions also tend to have weak-looking pincers, thin bodies, and thick tails, as opposed to the strong heavy pincers, thick bodies, and thin tails seen in nonlethal scorpions. The lethal members of the Buthidae family include the genera of *Tityus* which can be found in the Caribbean.

A scorpion has a flattened elongated body and can easily hide in cracks. Scorpions are members of the Arachnid (spider) family. The bodies consist of 3-segments, they also have 4 pairs of legs, a pair of claws, and a segmented tail that has a poisonous spike at the end. Scorpions vary in size from 1-20 cm in length.

However, scorpions may be found outside their habitat range of distribution when inadvertently transported with luggage and cargo.

## **Prevention**

Preventive measures include awareness of scorpions, shaking out clothing and boots before putting them on looking before reaching into likely hiding places and wearing gloves, long sleeved shirts and pants.

## **Symptoms**

In mild cases, the only symptom may be a mild tingling or burning at site of sting.

In severe cases, symptoms may include:

- Eyes and ears - Double vision
- Lungs - Difficulty breathing, No breathing, Rapid breathing,
- Nose, mouth, and throat – Drooling, Spasm of the voice box, Thick-feeling tongue
- Heart and blood - High blood pressure, Increased or decreased heart rate, Irregular heartbeat
- Kidneys and bladder Urinary incontinence, Urine output, decreased
- Muscles and joints - Muscle spasms
- Nervous system – Paralysis, Random movements of head, eye, or neck, Restlessness, Seizures, Stiffness
- Stomach and intestinal tract - Abdominal cramps, Fecal incontinence
- Other -Convulsions

## **Treatment**

1. Recognize scorpion sting symptoms:
2. Wash the area with soap and water.
3. Apply a cool compress on the area of the scorpion sting. Ice (wrapped in a washcloth or other suitable covering) may be applied to the sting location for 10 minutes. Remove compress for 10 minutes and repeat as necessary.
4. Call the Poison Control Center. If you develop symptoms of a poisonous scorpion sting, go to the nearest emergency care facility.
5. Keep your tetanus shots and boosters current.

## **Fire Ants (Caribbean)**

Fire ants are aggressive, reddish-brown to black ants that are 1/8 inch to 1/4 inch long. They construct nests, which are often visible as dome-shaped mounds of soil, sometimes as large as 3 feet across and 1 1/2 feet in height. In sandy soils, mounds are flatter and less visible. Fire ants usually build mounds in sunny, open areas such as lawns, pastures, cultivated fields and meadows, but they are not restricted to these areas. Mounds or nests may be located in rotting logs, around trees and stumps, under pavement and buildings, and occasionally indoors.

Fire ants use their stingers to immobilize or kill prey and to defend ant mounds from disturbance by larger animals, such as humans. Any disturbance sends hundreds of workers out to attack anything that moves. The ant grabs its victim with its mandibles (mouthparts) and then inserts its stinger. The process of stinging releases a chemical, which alerts other ants, inducing them to sting. In addition, one ant can sting several times without letting go with its mandibles.

Once stung, humans experience a sharp pain that lasts a couple of minutes, then after a while the sting starts itching and a welt appears. Fire ant venom contains alkaloids and a relatively small amount of protein. The alkaloids kill skin cells; this attracts white blood cells, which form a pustule within a few hours of being stung. The fluid in the pustule is sterile, but if the pustule is broken, the wound may become infected. The protein in the venom can cause allergic reactions that may require medical attention.

Some of the factors related to stinging insects that increase the risk associated with accidental contact are:

- The nests for these insects are frequently found in remote wooded or grassy areas and hidden in cavities
- The nests can be situated in trees, rocks, bushes or in the ground, and are usually difficult to see
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention

- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore, even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again

With these things in mind, and with the high probability of contact with stinging insects, use the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, inform the site Safety officer of this condition prior to participation in site activities
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the Site Safety officer if a stinging insect nest is located or suspected in the area
- Any nests located on site will be flagged off and site personnel will be notified of its presence
- If attacked, site personnel will immediately seek shelter and stay there. Do not jump in water (bees will still be in the area when you come up). Once safe, remove stings from your skin, it does not matter how you do it, but do it as quickly as possible to reduce the amount of venom they inject. Obtain first aid treatment and contact the safety officer who will observe for signs of allergic reaction

Treatment for fire ant stings is aimed at preventing secondary bacterial infection, which may occur if the pustule is scratched or broken. Clean the blisters with soap and water to prevent secondary infection. Do not break the blister. Topical corticosteroid ointments and oral antihistamines may relieve the itching associated with these reactions.

Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times

## Spiders

A large variety of spiders may be encountered during site activities. Extreme caution must be used when lifting logs and debris, since spiders are typically found in these areas.

While most spider bites merely cause localized pain, swelling, reddening, and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological affects caused by their venom, are dangerous.

**Black Widow:** The black widow is a coal-black bulbous spider 3/4 to 1 1/2 inches in length, with a bright red hourglass on the under side of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite
- Appearance of small punctures (but sometimes none are visible)
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities

**Brown Recluse:** The brown or violin spider is brownish to tan in color, rather flat, and 1/2 to 5/8 inches long. However, unlike the typical species, this spider has been encountered without a violin or “fiddle” shaped mark on the top of the head. Of the brown spider, there are three varieties found in the United States that present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite
- Formation of a large, red, swollen, postulating lesion with a bull's-eye appearance
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting
- Pain may become severe after 8 hours, with the onset of tissue necrosis

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, spider bites are not considered to be life threatening. However, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

#### **Brown Recluse Spider**



#### **Black Widow Spider**



First aid should include:

- If possible, catch the spider to confirm its identity. Even if the body is crushed, save it for identification
- Clean the bitten area with soap and water or rubbing alcohol
- To relieve pain, place an ice pack over the bite
- Keep the victim quiet and monitor breathing

Seek immediate medical attention

### **Sensitivity Reaction to Insect Stings or Bites**

A sensitivity reaction is one of the more dangerous and acute effects of insect bites or stings. It is the most common cause of fatalities from bites, particularly from bees, wasps, and spiders. Anaphylactic shock due to stings can lead to severe reactions in the circulatory, respiratory, and central nervous system. This can also result in death.

Site personnel must be questioned regarding their allergic reaction to insect bites. Anyone knowingly allergic should be required to carry and know how to use a response kit (e.g., Epi-Kit). First aid providers must be instructed on how to use the kit also. The kit must be inspected to ensure it is updated.

Administer first aid and observe persons reporting stings for signs of allergic reaction, such as unusual swelling, nausea, dizziness, and shock. At the first sign of these symptoms, take the individual to a medical facility for attention.

### **Insect Borne Diseases**

Diseases that are spread by insects include the following: Lyme Disease (tick); Bubonic and other forms of Plague (fleas); Malaria, West Nile Virus and Equine Encephalitis (mosquito).

### **Tick Borne Diseases**

Lyme disease is the second most rapidly spreading disease in the U.S.

### **Lyme Disease**

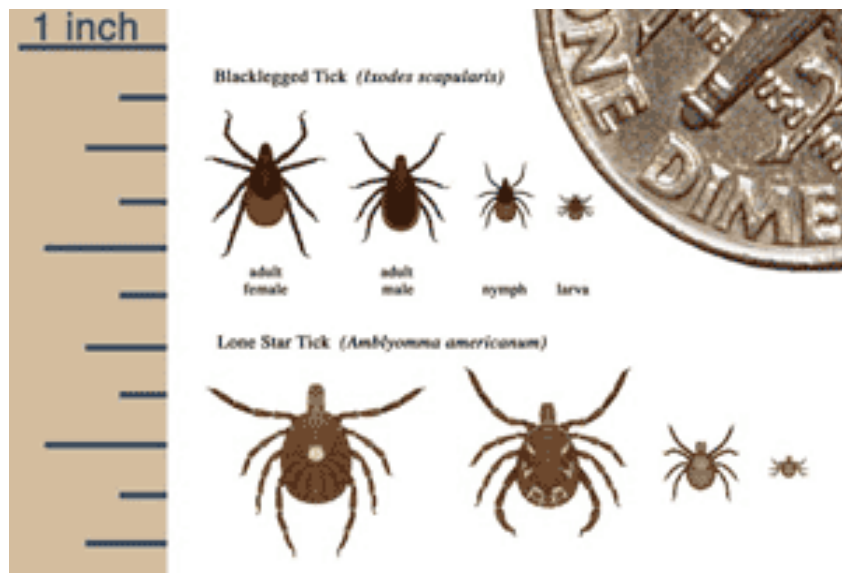
#### **1. Facts**

Definition:

- Bacterial infection transmitted by the bite of an infected black-legged tick more popularly known as the deer tick.
- Prevalence (nationwide and other countries).
- Three stages/sizes of deer ticks:
  - Larvae
  - Nymph
  - Adult

Tick season is May through October.

Not all ticks transmit Lyme disease (Black legged or deer tick [upper] compared to the Lone Star tick [lower])



- Ticks must be attached for several hours before Lyme disease can be transmitted.
- Being bitten by a tick does not mean you will get Lyme disease.

## 2. Prevention and Protection:

- Wear light-colored, tight-knit clothing.
- Wear long pants and long-sleeved shirts.
- Tuck pant legs into shoes or boots.
- Wear a hat.
- Use insect repellent containing DEET ((follow manufacturer's instructions for use).
- Check yourself daily for ticks after being in grassy, wooded areas.
- Request information from the Health and Safety Medical Section regarding Lyme Disease.

## 3. If Bitten:

- Remove the tick immediately with fine-tipped tweezers. Grasp the tick as close to the skin as possible. Pull gently but firmly without twisting or crushing the tick.
- Wash your hands and dab the bite with an antiseptic.

- Save the tick in a jar in some alcohol. Label the jar with the date of the bite, the area where you picked up the tick and the spot on your body where you were bitten.
- Monitor the bite for any signs of infection or rash.

#### 4. Symptoms:

Early Signs (may vary from person to person)

- Expanding skin rash.
- Flu-like symptoms during summer or early fall that include the following:
  - Chills, fever, headache, swollen lymph nodes.
  - Stiff neck, aching joints, and muscles.
  - Fatigue.
- Later signs
  - Nervous system problems.
  - Heart problems.
  - Arthritis, especially in knees.

#### 5. Upon Onset of Symptoms:

- Notify your Safety Officer (SO) and your supervisor.

### **Ehrlichiosis**

Ehrlichiosis is the general name used to describe several bacterial diseases that affect animals and humans. These diseases are caused by the organisms in the genus *Ehrlichia*. Worldwide, there are currently four ehrlichial species that are known to cause disease in humans.

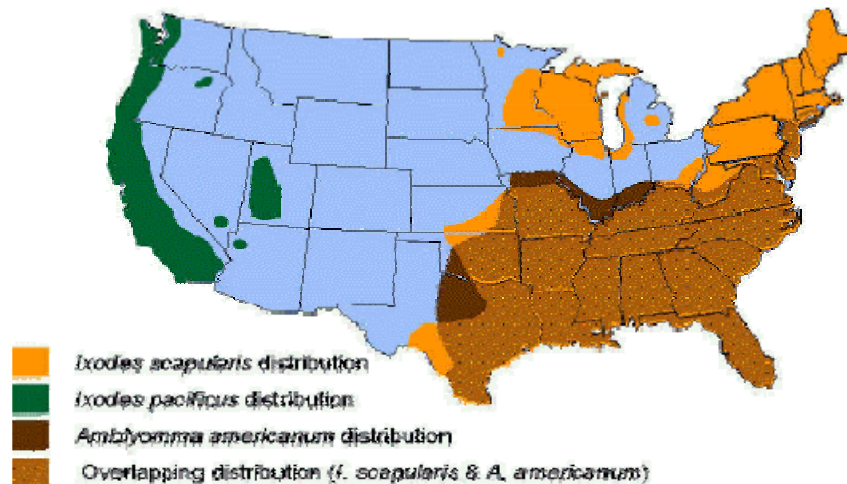
In the United States, ehrlichiae are transmitted by the bite of an infected tick. The lone star tick (*Amblyomma americanum*) and the blacklegged tick (*Ixodes scapularis*) are known vectors of ehrlichiosis.

The symptoms of ehrlichiosis may resemble symptoms of various other infectious and non-infectious diseases. These clinical features generally include fever, headache, fatigue, and muscle aches. Other signs and symptoms may include nausea, vomiting, diarrhea, cough, joint pains, confusion, and occasionally rash. Symptoms typically appear after an incubation period of 5-10 days following the tick bite. It is possible that many individuals who become infected with ehrlichiae do not become ill or they develop only very mild symptoms.

Most cases of ehrlichiosis are reported within the geographic distribution of the vector ticks (see map below). Occasionally, cases are reported from areas outside the distribution of the tick vector. In most instances, these cases have involved persons who traveled to areas where the diseases are endemic, and who had been bitten by an infected tick and developed symptoms after

returning home. Therefore, if you traveled to an ehrlichiosis-endemic area 2 weeks prior to becoming ill, you should tell your doctor where you traveled.

**Figure 20. Areas where human ehrlichiosis may occur based on approximate distribution of vector tick species**



A diagnosis of ehrlichiosis is based on a combination of clinical signs and symptoms and confirmatory laboratory tests. Blood samples can be sent to a reference laboratory for testing. However, the availability of the different types of laboratory tests varies considerably. Other laboratory findings indicative of ehrlichiosis include low white blood cell count, low platelet count, and elevated liver enzymes.

Ehrlichiosis is treated with a tetracycline antibiotic, usually doxycycline.

Very little is known about immunity to ehrlichial infections. Although it has been proposed that infection with ehrlichiae confers long-term protection against reinfection, there have been occasional reports of laboratory-confirmed reinfection. Short-term protection has been described in animals infected with some *Ehrlichia* species and this protection wanes after about 1 year. Clearly, more studies are needed to determine the extent and duration of protection against reinfection in humans.

Limiting exposure to ticks reduces the likelihood of infection in persons exposed to tick-infested habitats. Prompt careful inspection of your body and removal of crawling or attached ticks is an important method of preventing disease. It may take 24–48 hours of attachment before microorganisms are transmitted from the tick to you.

### **Preventive measures - Follow protection protocols for Lyme disease**

#### **Babesiosis**

Babesiosis is an intraerythrocytic parasitic infection caused by protozoa of the genus *Babesia* and transmitted through the bite of the *Ixodes* tick, the same vector responsible for transmission of Lyme disease. While most cases are tick-borne, transfusion and transplacental transmission

have been reported. In the United States, babesiosis is usually an asymptomatic infection in healthy individuals. Several groups of patients become symptomatic, and, within these subpopulations, significant morbidity and mortality occur. The disease most severely affects patients who are elderly, immunocompromised, or asplenic. Among those symptomatically infected, the mortality rate is 10% in the United States.

The primary vectors of the parasite are ticks of the genus *Ixodes*. In the United States, the black-legged tick, *Ixodes scapularis* (also known as *Ixodes dammini*) is the primary vector for the parasite. The *Ixodes* tick vector for *Babesia* is the same vector that locally transmits *Borrelia burgdorferi*, the agent implicated in Lyme disease. The primary US animal reservoir is the white-footed mouse, *Peromyscus leucopus*. Additionally, white-tailed deer serve as transport hosts for the adult tick vector, *I. scapularis*.

The Ixodid ticks ingest *Babesia* during feeding from the host, multiply the protozoa in their gut wall, and concentrate it in their salivary glands. The tick inoculates a new host when feeding again. The parasite then infects red blood cells (RBCs) and differentiated and undifferentiated trophozoites are produced. The former produce 2-4 merozoites that disrupt the RBC and go on to invade other RBCs. This leads to hemolytic anemia, thrombocytopenia, and atypical lymphocyte formation. Alterations in RBC membranes cause decreased conformability and increased red cell adherence, which can lead to development of acute respiratory distress syndrome (ARDS) among those severely affected.

The signs and symptoms mimic malaria and range in severity from asymptomatic to septic shock.

Symptoms include: Generalized weakness, fatigue, depression, fever, anorexia and weight loss, CNS - Headache, photophobia, neck stiffness, altered sensorium, pulmonary - Cough, shortness of breath, GI - Nausea, vomiting, abdominal pain, Musculoskeletal - Arthralgia and myalgia and Renal - Dark urine

## **Prevention**

Prevention measures are the same as for Lyme and other insect borne diseases

## **Tularemia**

**Tularemia** (also known as "rabbit fever") is a serious infectious disease caused by the bacterium *Francisella tularensis*. The disease is endemic in North America. The primary vectors are ticks and deer flies, but the disease can also be spread through other arthropods. Animals such as rabbits, prairie dogs, hares and muskrats serve as reservoir hosts.

Depending on the site of infection, tularemia has six characteristic clinical syndromes: ulceroglandular, glandular, oropharyngeal, pneumonic, oculoglandular, and typhoidal.

The disease has a very rapid onset, with headache, fatigue, dizziness, muscle pains, loss of appetite and nausea. Face and eyes redden and become inflamed. Inflammation spreads to the

lymph nodes, which enlarge and may suppurate (mimicking bubonic plague). Lymph node involvement is accompanied by a high fever. Death may result.

*Francisella tularensis* is one of the most infective bacteria known; fewer than ten organisms can cause disease leading to severe illness. The bacteria penetrate into the body through damaged skin and mucous membranes, or through inhalation. Humans are most often infected by tick bite or through handling an infected animal. Ingesting infected water, soil, or food can also cause infection. Tularemia can also be acquired by inhalation; hunters are at a higher risk for this disease because of the potential of inhaling the bacteria during the skinning process. Tularemia is not spread directly from person to person.

No vaccine is available to the general public. The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellent to prevent tick bites.

### **Prevention**

No vaccine is available to the general public. The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellent to prevent tick bites.

### **Other diseases primarily transmitted by Arthropods (Ticks, mites, lice etc.)**

**Typhus** (Not to be confused with Typhoid Fever [discussed in these FLDs])

*For the unrelated disease caused by *Salmonella typhi*, see Typhoid fever. For the unrelated disease caused by *Salmonella paratyphi*, please refer to Paratyphoid fever. For the monster of Greek mythology, see Typhus (monster).*

**Typhus** is any one of several similar diseases caused by louse-borne bacteria. The name comes from the Greek *typhos*, meaning smoky or lazy, describing the state of mind of those affected with typhus. *Rickettsia* is endemic in rodent hosts, including mice and rats, and spreads to humans through mites, fleas and body lice. The arthropod vector flourishes under conditions of poor hygiene, such as those found in prisons or refugee camps, amongst the homeless, or until the middle of the 20th century, in armies in the field. In tropical countries, typhus is often mistaken for dengue fever.

### **Endemic typhu**

Endemic typhus (also called "flea-borne typhus" and "murine typhus" or "rat flea typhus") is caused by the bacteria *Rickettsia typhi*, and is transmitted by the flea that infest rats. Symptoms of endemic typhus include headache, fever, chills, myalgia, nausea, vomiting, and cough.

Endemic typhus is highly treatable with antibiotics. Most people recover fully, but death may occur in the elderly, severely disabled or patients with a depressed immune system.

## **Encephalitis Arboviral Encephalitides**

### **Perspectives**

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus Alphavirus, *Flaviviridae*, and *Bunyaviridae*).

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

Arboviral encephalitides have a global distribution, but there are four main virus agents of encephalitis in the United States, all of which are transmitted by mosquitoes. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

**There is expanded discussion of several of these diseases (West Nile and Eastern Equine Encephalitis elsewhere in this document. A more general discussion is found in Attachment 2.**

## Mosquito Borne Diseases

### Malaria

**Malaria** is a mosquito-borne disease caused by a parasite. Four kinds of malaria parasites can infect humans: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*.



People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die. Each year 350-500 million cases of malaria occur worldwide. Infection with any of the malaria species can make a person feel very ill; infection with *P. falciparum*, if not promptly treated, may be fatal. Although malaria can be a fatal disease, illness and death from malaria are largely preventable.

This sometimes fatal disease can be prevented and cured. Bed nets, insecticides, and anti-malarial drugs are effective tools to fight malaria in areas where it is transmitted. Travelers to a malaria-risk area should avoid mosquito bites and take a preventive anti-malarial drug. Malaria was eradicated from the United States in the early 1950s. However, malaria is common in many developing countries and travelers who visit these areas risk getting malaria.

Returning travelers and arriving immigrants could also reintroduce the disease in the United States if they are infected with malaria when they return. The mosquito that transmits malaria, *Anopheles*, is found throughout much of the United States. If local mosquitoes bite an infected person, those mosquitoes can, in turn, infect local residents (*introduced malaria*).

Because the malaria parasite is found in red blood cells, malaria can also be transmitted through blood transfusion, organ transplant, or the shared use of needles or syringes contaminated with blood. Malaria may also be transmitted from a mother to her fetus before or during delivery ("congenital" malaria).

Malaria is not transmitted from person to person like a cold or the flu. You cannot get malaria from casual contact with malaria-infected people.

## **Prevention and control**

You can prevent malaria by:

- keeping mosquitoes from biting you, especially at night
- taking anti-malarial drugs to kill the parasites
- eliminating places where mosquitoes breed
- spraying insecticides on walls to kill adult mosquitoes that come inside
- sleeping under bed nets - especially effective if they have been treated with insecticide,
- wearing insect repellent and long-sleeved clothing if out of doors at night

The surest way for you and your health-care provider to know whether you have malaria is to have a diagnostic test where a drop of your blood is examined under the microscope for the presence of malaria parasites. If you are sick and there is any suspicion of malaria (for example, if you have recently traveled in a malaria-risk area) the test should be performed without delay.

The disease should be treated early in its course, before it becomes severe and poses a risk to the patient's life. Several good anti-malarial drugs are available, and should be administered early on. The most important step is to think about malaria, so that the disease is diagnosed and treated in time.

## **West Nile Virus**

West Nile virus (WNV) is a potentially serious illness. Experts believe WNV is established as a seasonal epidemic in North America that flares up in the summer and continues into the fall. This fact sheet contains important information that can help you recognize and prevent WNV.

The easiest and best way to avoid WNV is to prevent mosquito bites.

- When you are outdoors, use insect repellent containing an EPA-registered active ingredient. Follow the directions on the package.
- Many mosquitoes are most active at dusk and dawn. Be sure to use insect repellent and wear long sleeves and pants at these times or consider staying indoors during these hours.
- Make sure you have good screens on your windows and doors to keep mosquitoes out.
- Get rid of mosquito breeding sites by emptying standing water from buckets, barrels and drainage ditches.

About one in 150 people infected with WNV will develop severe illness. The severe symptoms can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. These symptoms may last several weeks, and neurological effects may be permanent.

Up to 20 percent of the people who become infected have symptoms such as fever, headache, and body aches, nausea, vomiting, and sometimes swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms can last for as short as a few days, though even healthy people have become sick for several weeks.

Approximately 80 percent of people (about 4 out of 5) who are infected with WNV will not show any symptoms at all. Most often, WNV is spread by the bite of an infected mosquito. Mosquitoes become infected when they feed on infected birds. Infected mosquitoes can then spread WNV to humans and other animals when they bite.

In a very small number of cases, WNV also has been spread through blood transfusions, organ transplants, breastfeeding and even during pregnancy from mother to baby.

WNV is not spread through casual contact such as touching or kissing a person with the virus.

Symptoms typically develop between 3 - 14 days after being bitten by an infected mosquito.

There is no specific treatment for WNV infection. In cases with milder symptoms, people experience symptoms such as fever and aches that pass on their own, although even healthy people have become sick for several weeks. In more severe cases, people usually need to go to the hospital where they can receive supportive treatment including intravenous fluids, help with breathing and nursing care.

Milder WNV illness improves on its own, and people do not necessarily need to seek medical attention for this infection though they may choose to do so. If you develop symptoms of severe WNV illness, such as unusually severe headaches or confusion, seek medical attention immediately. Severe WNV illness usually requires hospitalization. Pregnant women and nursing mothers are encouraged to talk to their doctor if they develop symptoms that could be WNV. People over the age of 50 are more likely to develop serious symptoms of WNV if they do get sick and should take special care to avoid mosquito bites.

The more time you're outdoors, the more time you could be bitten by an infected mosquito. Pay attention to avoiding mosquito bites if you spend a lot of time outside, either working or playing.

All donated blood is checked for WNV before being used. The risk of getting WNV through blood transfusions and organ transplants is very small, and should not prevent people who need surgery from having it. If you have concerns, talk to your doctor.

## **Equine Encephalitis**

Eastern equine encephalitis (EEE) is a mosquito-borne viral disease. EEE virus (EEEV) occurs in the eastern half of the United States where it causes disease in humans, horses, and some bird species. Because of the high mortality rate, EEE is regarded as one of the most serious mosquito-borne diseases in the United States.

EEEV is transmitted to humans through the bite of an infected mosquito. It generally takes from 3 to 10 days to develop symptoms of EEE after being bitten by an infected mosquito. The main EEEV transmission cycle is between birds and mosquitoes.

Many species of mosquitoes can become infected with EEEV. The most important mosquito species in maintaining the bird-mosquito transmission cycle is *Culiseta melanura*, which reproduces in freshwater hardwood swamps. *Culiseta melanura*, however, is not considered to be an important vector of EEEV to horses or humans because it feeds almost exclusively on birds.

Transmission to horses or humans requires mosquito species capable of creating a “bridge” between infected birds and uninfected mammals such as some *Aedes*, *Coquillettidia*, and *Culex* species.

Horses are susceptible to EEE and some cases are fatal. EEEV infections in horses, however, are not a significant risk factor for human infection because horses are considered to be “dead-end” hosts for the virus (i.e., the amount of EEEV in their bloodstreams is usually insufficient to infect mosquitoes).

Eastern equine encephalitis virus is a member of the family Togaviridae, genus *Alphavirus* closely related to Western equine encephalitis virus and Venezuelan equine encephalitis virus

Many persons infected with EEEV have no apparent illness. In those persons who do develop illness, symptoms range from mild flu-like illness to inflammation of the brain, coma and death.

The mortality rate from EEE is approximately one-third, making it one of the most deadly mosquito-borne diseases in the United States.

There is no specific treatment for EEE; optimal medical care includes hospitalization and supportive care (for example, expert nursing care, respiratory support, prevention of secondary bacterial infections, and physical therapy, depending on the situation).

Approximately half of those persons who survive EEE will have mild to severe permanent neurologic damage.

Incidence rate includes:

- Approximately 220 confirmed cases in the US 1964-2004, Average of 5 cases/year, with a range from 0-15 cases
- States with largest number of cases includes New Jersey.
- EEEV transmission is most common in and around freshwater hardwood swamps in the Atlantic Coast states and the Great Lakes region.

- Human cases occur relatively infrequently, largely because the primary transmission cycle takes place in and around swampy areas where human populations tend to be limited.

### **Risk Groups:**

- Residents of and visitors to endemic areas (areas with an established presence of the virus)
- People who engage in outdoor work and recreational activities in endemic areas.
- Persons over age 50 and younger than age 15 seem to be at greatest risk for developing severe EEE when infected with the virus.

### **Prevention**

- A vaccine is available to protect equines.
- People should avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active (some bridge vectors of EEEV are aggressive day-biters), and removing standing water that can provide mosquito breeding sites.
- There are laboratory tests to diagnosis EEEV infection including serology, especially IgM testing of serum and cerebrospinal fluid (CSF), and neutralizing antibody testing of acute- and convalescent-phase serum.

### **Meningitis**

Meningitis is a viral disease that can affect the central nervous system that is transmitted through the bite from an infected mosquito.

Symptoms can be nonexistent or severe and flu-like, with fever, chills, tiredness, headache, nausea and vomiting. If not treated promptly the disease can be fatal.

### **Prevention**

- A vaccine is available. It's 80% effective after a single dose and 97.5% effective after a second dose.

Use precautions as for other mosquito borne diseases. Avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active and removing standing water that can provide mosquito breeding sites.

### **Deer Flies (See Tularemia above)**

## **Fleas**

Flea is a common name for insects of the order Siphonaptera which are wingless insects with mouthparts adapted for piercing skin and sucking blood. Fleas are external parasites, living by hematophagy off the blood of mammals (including humans). Some species include the cat flea (*Ctenocephalides felis*), dog flea (*Ctenocephalides canis*), and human flea (*Pulex irritans*).

Fleas are small (1.5 to 3.3 mm) long, agile, dark-colored, wingless insect with tube-like mouth parts adapted to feeding on the blood of their hosts. Their legs are long, with the hind pair well adapted for jumping. A flea can jump vertically up to seven inches and horizontally up to 13 inches. The flea body is hard, polished, and covered with many hairs and short spines directed backwards which assists its movement on the host. The body is able to withstand great pressure. Hard squeezing between the fingers is not normally sufficient to kill a flea.

Fleas lay tiny white oval-shaped eggs. The larva is small, pale, has bristles covering its worm-like body, lacks eyes, and has mouthparts adapted to chewing.

Fleas can cause medical problems include flea allergy dermatitis, secondary skin irritations and, in extreme cases, anemia, tapeworms, and stomach flu. Fleas can transmit murine typhus (endemic typhus) fever among animals and from animal to humans. Fleas can also transmit bubonic plague. Tapeworms normally infest in human severe cases. Although the bite is rarely felt, it is the resulting irritation caused by the flea salivary secretions that varies among individuals. Some result in a severe reaction including a general rash or inflammation resulting in secondary infections caused by scratching the irritated skin. Most bites are found on the feet and legs with the formation of small, hard, red, slightly raised itching spots with a single puncture point in the center of each spot.

### **Treatment**

Flea bites can be treated with anti-itch creams, usually antihistamines or hydrocortisone.

## **Bed Bugs**

Bed bugs are small parasitic insects that feed on human blood. A number of health effects may occur due to bed bugs including skin rashes, prominent blisters, psychological effects and allergic symptoms. Diagnosis involves finding the bed bugs and the occurrence of compatible symptoms. Treatment is otherwise symptomatic.

Adult bed bugs are reddish-brown, flattened, oval and wingless. Bed bugs have microscopic hairs that give them a banded appearance. Adults grow to 4-5mm in length and 1.5-3 mm wide. A bed bug pierces the skin of its host with two hollow feeding tubes shaped like tongues. The one tube injects its saliva, which contains anticoagulants and anesthetics, while the other draws blood of its host. After feeding for approximately five minutes, the bug returns to its hiding place. Although bed bugs can live for a year without feeding, they normally feed every five to ten days.

Eradication of bed bugs frequently requires a combination of pesticide and non-pesticide approaches. Pyrethroids, dichlorvos, and malathion have historically been effective. Mechanical approaches include vacuuming and heat treating or wrapping mattresses have also been recommended.

**ATTACHMENT 1**  
**RICKETTSIAL INFECTIONS**

## **Rickettsial Infections**

### **Description**

Many species of *Rickettsia* can cause illnesses in humans (Table below). The term “rickettsiae” conventionally embraces a polyphyletic group of microorganisms in the class Proteobacteria, comprising species belonging to the genera *Rickettsia*, *Ehrlichia*, *Coxiella*, and *Bartonella*. These agents are usually not transmissible directly from person to person except by blood transfusion or organ transplantation, although sexual and placental transmission has been proposed for *Coxiella*. Transmission generally occurs via an infected arthropod vector or through exposure to an infected animal reservoir host. However, sennetsu fever is acquired following consumption of raw fish products. The clinical severity and duration of illnesses associated with different rickettsial infections vary considerably, even within a given antigenic group. Rickettsioses range in severity from diseases that are usually relatively mild (cat scratch disease) to those that can be life-threatening (murine typhus) and they vary in duration from those that can be self-limiting to chronic (Q fever and bartonellosis) or recrudescent (Brill-Zinsser disease). Most patients with rickettsial infections recover with timely use of appropriate antibiotic therapy.

Travelers may be at risk for exposure to agents of rickettsial diseases if they engage in occupational or recreational activities which bring them into contact with habitats that support the vectors or animal reservoir species associated with these pathogens.

The geographic distribution and the risks for exposure to rickettsial agents are described below and in the Table below.

### **Trench Fever**

Trench fever, which is caused by *Bartonella quintana*, is transmitted from one person to another by the human body louse. Contemporary outbreaks of both diseases are rare in most developed countries and generally occur only in communities and populations in which body louse infestations are frequent, especially during the colder months when louse-infested clothing is not laundered. Foci of trench fever have also been recognized among homeless populations in urban centers of industrialized countries. Travelers who are not at risk of exposure to body lice or to persons with lice are unlikely to acquire these illnesses. However, health-care workers who care for these patients may be at risk for acquiring louse-borne illnesses through inhalation or inoculation of infectious louse feces into the skin or conjunctiva.

## Murine Typhus

Murine typhus, which is caused by infection with *Rickettsia typhi*, is transmitted to humans by rat fleas, particularly during exposure in rat-infested buildings (3). Flea-infested rats can be found throughout the year in humid tropical environments, especially in harbor or riverine environments. In temperate regions, they are most common during the warm summer months.

Travelers who participate in outdoor activities in grassy or wooded areas (e.g., trekking, camping, or going on safari) may be at risk for acquiring tick-borne illnesses, including those caused by *Rickettsia*, and *Ehrlichia* species (see below).

**TABLE Epidemiologic features and symptoms of rickettsial diseases**

ANTIGENIC GROUP	DISEASE	AGENT	PREDOMINANT SYMPTOMS*	VECTOR OR ACQUISITION MECHANISM	ANIMAL RESERVOIR	GEOGRAPHIC DISTRIBUTION OUTSIDE THE US
Typhus fevers	Murine typhus	<i>R. typhi</i>	As above, generally less severe	Rat flea	Rats, mice	Worldwide
Spotted fevers						
Coxiella	Q fever	<i>Coxiella burnetii</i>	Fever, headache, chills, sweating, pneumonia, hepatitis, endocarditis	Most human infections are acquired by inhalation of infectious aerosols; tick	Goats, sheep, cattle, domestic cats, other	Worldwide
Bartonella	Cat-scratch disease	<i>Bartonella henselae</i>	Fever, adenopathy, neuroretinitis, encephalitis	Cat flea	Domestic cats	Worldwide
	Trench fever	<i>B. quintana</i>	Fever, headache, pain in shins, splenomegaly, disseminated rash	Human body louse	Humans	Worldwide
Ehrlichia	Ehrlichiosis	<i>Ehrlichia chaffeensis</i> <sup>#</sup>	Fever, headache, nausea, occasionally rash	Tick	Various large and small mammals, including deer and rodents	Worldwide

This represents only a partial list of symptoms. Patients may have different symptoms or only a few of those listed.

## Anaplasmosis and Ehrlichiosis

Human ehrlichiosis and anaplasmosis are acute tick-borne diseases, associated with the lone star tick, *Amblyomma americanum*, and *Ixodes* ticks, respectively. Because one tick may be infected with more than one tick-borne pathogen (e.g. *Borrelia burgdorferi*, the causative agent of Lyme disease, or various *Babesia* species, agent of human babesiosis), patients may be present with

atypical clinical symptoms that complicate treatment. Ehrlichioses and anaplasmosis are characterized by infection of different types of leukocytes, where the causative agent multiplies in cytoplasmic membrane-bound vacuole called morulae. Morulae can sometimes be detected in Giemsa-stained blood smears.

## **Q FEVER**

Q fever occurs worldwide, most often in persons who have contact with infected goat, sheep, cat and cattle, particularly parturient animals (especially farmers, veterinarians, butchers, meat packers, and seasonal workers). Travelers who visit farms or rural communities can be exposed to *Coxiella burnetii*, the agent of Q fever, through airborne transmission (via animal-contaminated soil and dust) or less commonly through consumption of unpasteurized milk products or by exposure to infected ticks. These infections may initially result in only mild and self-limiting influenza-like illnesses, but if untreated, infections may become chronic, particularly in persons with preexisting heart valve abnormalities or with prosthetic valves. Such persons can develop chronic and potentially fatal endocarditis.

## **Cat-Scratch Disease**

Cat-scratch disease is contracted through scratches and bites from domestic cats, particularly kittens, infected with *Bartonella henselae*, and possibly from their fleas (3, 4). Exposure can therefore occur wherever cats are found.

## **Symptoms**

Clinical presentations of rickettsial illnesses vary (Table above), but common early symptoms, including fever, headache, and malaise, are generally nonspecific. Illnesses resulting from infection with rickettsial agents may go unrecognized or are attributed to other causes. Atypical presentations are common and may be expected with poorly characterized non-indigenous agents, so appropriate samples for examination by specialized reference laboratories should be obtained. A diagnosis of rickettsial diseases is based on two or more of the following: 1) clinical symptoms and an epidemiologic history compatible with a rickettsial disease, 2) the development of specific convalescent-phase antibodies reactive with a given pathogen or antigenic group, 3) a positive polymerase chain reaction test result, 4) specific immunohistologic detection of rickettsial agent, or 5) isolation of a rickettsial agent. Ascertaining the likely place and the nature of potential exposures is particularly helpful for accurate diagnostic testing.

## Prevention

With the exception of the louse-borne diseases described above, for which contact with infectious arthropod feces is the primary mode of transmission (through autoinoculation into a wound, conjunctiva, or inhalation), travelers and health-care providers are generally not at risk for becoming infected via exposure to an ill person. Limiting exposures to vectors or animal reservoirs remains the best means for reducing the risk for disease. Travelers and persons working in areas where organisms may be present should implement prevention based on avoidance of vector-infested habitats, use of repellents and protective clothing, prompt detection and removal of arthropods from clothing and skin, and attention to hygiene.

Q fever and *Bartonella* group diseases may pose a special risk for persons with abnormal or prosthetic heart valves, and *Rickettsia*, *Ehrlichia*, and *Bartonella* for persons who are immunocompromised.

## **ATTACHMENT 2**

### **ENCEPHALITIS ARBOVIRAL ENCEPHALITIDES**

## Encephalitis Arboviral Encephalitides

### Perspectives

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus Alphavirus, *Flaviviridae*, and *Bunyaviridae*).

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

Arboviral encephalitides have a global distribution which is transmitted by mosquitoes. Powassan, is a minor cause of encephalitis in the northern United States, and is transmitted by ticks. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

The majority of human infections is asymptomatic or may result in a nonspecific flu-like syndrome. Onset may be insidious or sudden with fever, headache, myalgias, malaise and occasionally prostration. Infection may, however, lead to encephalitis, with a fatal outcome or permanent neurologic sequelae. Fortunately, only a small proportion of infected persons progress to frank encephalitis.

Experimental studies have shown that invasion of the central nervous system (CNS), generally follows initial virus replication in various peripheral sites and a period of viremia. Viral transfer from the blood to the CNS through the olfactory tract has been suggested. Because the arboviral encephalitides are viral diseases, antibiotics are not effective for treatment and no effective antiviral drugs have yet been discovered.

## Prevention

Arboviral encephalitis can be prevented in two major ways: personal protective measures and public health measures to reduce the population of infected mosquitoes. Personal measures include reducing time outdoors particularly in early evening hours, wearing long pants and long sleeved shirts and applying mosquito repellent to exposed skin areas. Public health measures often require spraying of insecticides to kill juvenile (larvae) and adult mosquitoes.

Selection of mosquito control methods depends on what needs to be achieved; but, in most emergency situations, the preferred method to achieve maximum results over a wide area is aerial spraying. In many states aerial spraying may be available in certain locations as a means to control nuisance mosquitoes. Such resources can be redirected to areas of virus activity. When aerial spraying is not routinely used, such services are usually contracted for a given time period. Financing of aerial spraying costs during large outbreaks is usually provided by state emergency contingency funds. Federal funding of emergency spraying is rare and almost always requires a federal disaster declaration. Such disaster declarations usually occur when the vector-borne disease has the potential to infect large numbers of people, when a large population is at risk and when the area requiring treatment is extensive. Special large planes maintained by the United States Air Force can be called upon to deliver the insecticide(s) chosen for such emergencies. Federal disaster declarations have relied heavily on risk assessment by the CDC.

There are no commercially available human vaccines for these U.S. diseases.

## **Powassan Encephalitis**

Powassan (POW) virus is a flavivirus and currently the only well documented tick-borne transmitted arbovirus occurring in the United States and Canada. Recently a Powassan-like virus was isolated from the deer tick, *Ixodes scapularis*. Its relationship to POW and its ability to cause human disease has not been fully elucidated. POW's range in the United States is primarily in the upper tier States. In addition to isolations from man, the virus has been recovered from ticks (*Ixodes marxi*, *I. cookei* and *Dermacentor andersoni*) and from the tissues of a skunk (*Spilogale putorius*). It is a rare cause of acute viral encephalitis. POW virus was first isolated from the brain of a 5-year-old child who died in Ontario in 1958. Patients who recover may have residual neurological problems.

## **Other Arboviral Encephalitides**

Many other arboviral encephalitides occur throughout the world. Most of these diseases are problems only for those individuals traveling to countries where the viruses are endemic.

## **West Nile Encephalitis**

Discussed elsewhere in this document

## FLD 43 D HAZARDOUS PLANTS

A number of hazardous plants may be encountered during field operations. The ailments associated with these plants range from mild hay fever to contact dermatitis. Plants that present the greatest risk to site workers are those that produce allergic reactions and tissue injury.

### Plants That Cause Skin and Tissue Injury

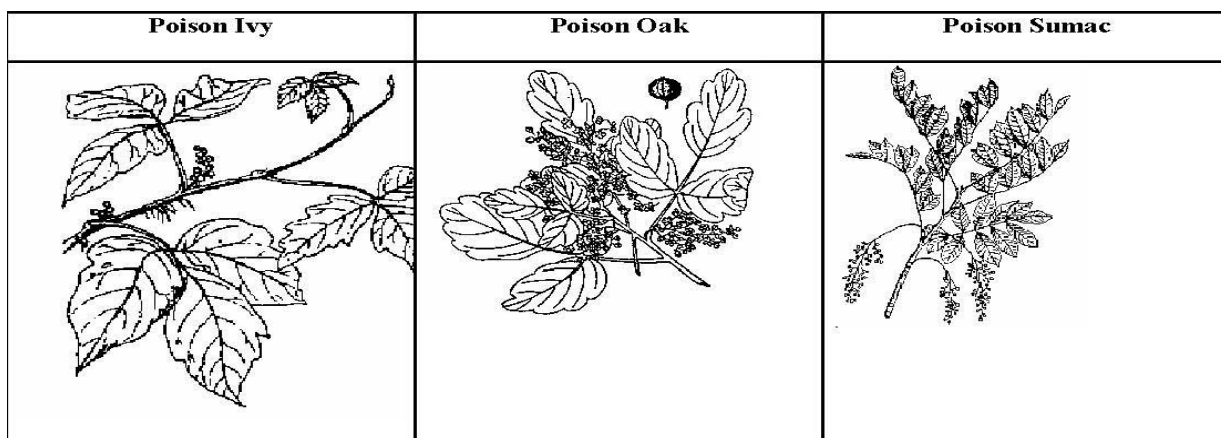
Contact with sharp leaves and thorns are of special concern to site personnel. This concern stems from the fact that punctures, cuts, and even minor scrapes caused by accidental contact may result in skin lesions and the introduction of fungi or bacteria through the skin. This is especially important in light of the fact that the warm moist environment created inside protective clothing is ideal for the propagation of fungal and bacterial infection. Personnel receiving any of the injuries listed above, even minor scrapes shall report immediately for continued observation and care. Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

### Plants That Cause an Allergic Reaction

The poisonous plants of greatest concern are poison ivy, poison oak, and poison sumac. Contact with the poisonous sap of these plants produces a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim also may develop a high fever and may be very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. In certain seasons, both plants also have greenish-white flowers and berries that grow in clusters. Poison sumac is a tall shrub or small tree with 6 to 12 leaflets arranged in pairs with a single leaflet at the end. This plant grows in wooded, swampy areas.

**Poison Ivy/Poison Oak/Poison Sumac**



The reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact
- Reddening, swelling, itching and burning at the site of contact
- Pain, if the reaction is severe
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin

If the rash is scratched, secondary infections can occur. Preventive measures that are effective for most site personnel include:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify, report and mark poisonous plants found on site
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution

Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

### **Plants That are Poisonous**

There are a number of plants worldwide beside poison ivy, oak and sumac which have poisonous properties. In many cases consumption of these plants or parts of these plants can result in poisoning. In other cases, contact with the plants may be poisonous. The following is a listing with pertinent information on poisonous properties and locations of a number of plants.

In general, when working in the outdoors or where you may come in contact with household plants or where your families may come in contact with these plants, it is important that as soon as possible after contact the area or areas should be thoroughly washed and hands must be thoroughly washed before eating drinking, smoking or any other hand to mouth contact.

In keeping with our 24/7 BBS concept, it is important to remember that children are particularly vulnerable to many of the poisonous parts of these plants. Many of these poisonous parts resemble non-poisonous food items such as berries and are attractive.

As with most lists there is extensive information but the list may not include all poisonous plants.

It is important to remember that this document is a starting point to be supplemented with local information. The majority of this information is from a list found in Wikipedia an on line Dictionary readily accessible via Google. The website has pictures of these plants as well as links to other information sources.

# POISONOUS PLANTS

From Wikipedia,

This is a list of plants containing poisonous parts that pose a serious risk of illness, injury, or death to humans.

## Poisonous Food Plants

- Apple (*Malus domestica*) **Found worldwide in cooler climates.** Seeds contain cyanogenic glycosides; although the amount found in most apples won't kill a person.
- Cherry (*Prunus cerasus*), as well as other species (*Prunus spp*) such as peach (*Prunus persica*), plum (*Prunus domestica*), almond (*Prunus dulcis*) and apricot (*Prunus armeninaca*). **There are around 430 species of *Prunus*, spread throughout the northern temperate regions of the globe.** Leaves and seeds contain cyanogenic glycosides
- Rhubarb (*Rheum rhaponticum*) **Found worldwide.** Leaves, but not stems, contain oxalic acid salts, causing kidney disorders, convulsions, and coma. Rarely fatal.
- Tomato (*Solanum lycopersicum*) **Found worldwide.** Foliage and vines contain alkaloid poisons which cause digestive upset and nervous excitement.

## Other Poisonous Plants

- Autumn crocus. **Found in North America.** The bulbs are poisonous and cause nausea, vomiting, diarrhea. **Can be fatal.**
- Azalea **Found Worldwide.** All parts of the plant are poisonous and cause nausea, vomiting, depression, breathing difficulties, and coma. Rarely fatal.
- Bittersweet nightshade **Naturalized in North America.** All parts are poisonous, containing solanine and causing fatigue, paralysis, convulsions and diarrhea. Rarely fatal.
- Bleeding heart / Dutchman's breeches. **Found in North America.** Leaves and roots are poisonous and cause convulsions and other nervous symptoms.
- Black locust. **Naturalized in North America.** Pods are toxic
- Caladium / Elephant ear. **Ornamental plants in North America.** All parts of the plant are poisonous. Symptoms are generally irritation, pain, and swelling of tissues. If the mouth or tongue swells, breathing may be fatally blocked.

- Castor Oil Plant (*Ricinus communis*) Castor Oil Plant. **Found Worldwide.** The phytotoxin is **ricin**, an extremely toxic water soluble protein, which is concentrated in the seed. Also present are ricinine, an alkaloid, and an irritant oil. Causes burning in mouth and throat, convulsions, and is **often fatal**.
- Daffodil. **Found worldwide.** The bulbs are poisonous and cause nausea, vomiting, and diarrhea. **Can be fatal.**
- Daphne (*Daphne sp.*) **Ornamental plant worldwide.** The berries (either red or yellow) are poisonous, causing burns to mouth and digestive tract, followed by coma. **Often fatal.**
- Darnel/Poison Ryegrass (*Lolium temulentum*) **Usually grows in the same production zones as wheat and is considered a weed.** The seeds and seed heads of this common garden weed may contain the alkaloids temuline and loline. Some experts also point to the fungus ergot or fungi of the genus endoconidium both of which grow on the seed heads of rye grasses as an additional source of toxicity.
- Deadly nightshade (*Atropa belladonna*) **Naturalized in parts of North America.** All parts of the plant contain the toxic alkaloid atropine. The young plants and seeds are especially poisonous, causing nausea, muscle twitches, paralysis; **often fatal**.
- Dumbcane / dieffenbachia. **Found in tropical areas and popular as house plants.** All parts are poisonous, causing intense burning, irritation, and immobility of the tongue, mouth, and throat. Swelling can be severe enough to block breathing leading to death.
- Ivy. **Native to North America** where winters are not severe. The leaves and berries are poisonous, causing stomach pains, labored breathing, possible coma.
- Jerusalem cherry **United States** All parts, especially the berries, are poisonous, causing nausea and vomiting. **Looks like a cherry tomato.** It is occasionally fatal, especially to children.
- Lilies **Worldwide** There are some 3500 species that comprise the lily (Lilaceae) family. Some are beneficial including (foods such as onion, shallot, garlic, chives [all *Allium* spp] and asparagus) and some with medicinal uses (colchicine and red squill) Many produce alkalids which are poisonous, especially to cats.
- Manchineel (*Hippomane mancinella*) **Native to the Caribbean (including Puerto Rico and the Virgin Islands).** It is one of the most poisonous trees in the world All parts of this tree including the fruit contain toxic phorbol esters typical of the Euphorbiaceae. Sap may cause burning of the skin and smoke from burning may cause eye irritation and blindness. Fruits, which are similar in appearance to an apple, are green or greenish-yellow when ripe.
- Oak Worldwide Most species foliage and acorns are mildly poisonous, causing digestive upset, heart trouble, contact dermatitis. Rarely fatal.

- Poison-ivy (*Toxicodendron radicans*), Poison-oak (*T. diversilobum*), and Poison Sumac (*T. vernix*) **North America** All parts of these plants contain a highly irritating oil with urushiol (this is actually not a poison but an allergen). Skin reactions can include blisters and rashes. It spreads readily to clothes and back again, and has a very long life. Infections can follow scratching.
- Pokeweed (*Phytolacca sp.*) **Native to North America.** Leaves, berries and roots contain phytolaccatoxin and phytolaccigenin - toxin in young leaves is reduced with each boiling and draining.

## **FLD 49 SAFE STORAGE OF SAMPLES**

### **REFERENCE**

DOT Emergency Response Guide (ERG)

To ensure that multi-media samples collected in the course of WESTON work assignments are not stored in a manner that creates undue hazard to WESTON employees or others.

### **PROCEDURE**

Samples that are transported from a WESTON work location must be classified and packaged in compliance with U.S. Department of Transportation (DOT) regulations or alternatively in accordance with International Air Transport Association (IATA) regulations. WESTON's manual of Procedures for Shipping and Transporting Dangerous Goods must be consulted to determine if the samples will be classified as either "environmental" or "hazardous materials" samples.

#### **Environmental Samples**

Environmental samples are not subject to DOT or IATA dangerous goods regulations and must be packaged to protect their integrity during transportation and temporary storage and should have appropriate chain-of-custody documentation. These samples may be brought to a WESTON office location or rented space to verify sample documentation and repackaging (e.g., with ice or cold packs). Minor spill clean-up capability is required.

Once secured for shipment, these samples can be temporarily stored for the next day ground or air shipment pick-up. Under no circumstances are samples to be stored beyond the time necessary to arrange for transportation to a laboratory.

#### **Hazardous Materials Samples**

These samples are subject to DOT and/or IATA dangerous goods regulations and must be packaged and labeled according to the appropriate regulations, including completed chain-of-custody documentation prior to being transported from the WESTON work site. WESTON drivers must have the documentation for the samples and a DOT Emergency Response Guide (ERG) readily available in the vehicle. The ERG is available on-line at: <http://hazmat.dot.gov/pubs/erg/gydebook.htm> and appropriate sections can be copied to accompany samples being transported by vehicles driven by WESTON employees.

Under normal circumstances these samples should be shipped from the field and never brought back to a WESTON office location or into a rented space. If it is not possible to ship the samples from the field during the same day they are collected, a properly packaged, labeled, and sealed sample shipping container may be brought back to a WESTON office location for shipment to a laboratory the next business day - provided the temporary storage location is secure from access by any personnel who are not trained in shipping hazardous materials. Under no circumstances are samples to be stored in rented space; if necessary, secure temporary storage in a locked vehicle may be authorized. Note that some office leases do not permit the storage of hazardous materials and the lease will govern whether such materials can be stored overnight.

## **INSPECTION FOLLOW-UP**

Shipping procedures for samples should be included in the site-specific health and safety plan (HASP) and reviewed for compliance with these procedures prior to approval. EHS audits will include a review to sample shipping and storage procedures.

## **FLD 56 DRILLING SAFETY**

### **REFERENCES**

*WESTON Corporate Environmental, Health, and Safety Program  
Environmental Remediation Drilling Safety Guideline (AntiEntropics, Inc., 2005)*

### **RELATED FLDs**

*FLD02 – Inclement Weather  
FLD03 – Hot Processes  
FLD10 – Manual Lifting and Handling of Heavy Objects  
FLD11 – Rough Terrain  
FLD12 – Housekeeping  
FLD20 – Traffic  
FLD22 – Heavy Equipment Operation  
FLD30 – Hazardous Materials Use and Storage  
FLD31 – Fire Prevention and Protection Planning  
FLD32 – Fire Extinguishers Required and Requirements  
FLD34 – Utilities  
FLD35 – Electrical Safety  
FLD38 – Hand and Power Hand Tools  
FLD47 – Clearing, Grubbing, and Logging Operations  
FLD57 – Motor Vehicle Safety*

### **INTRODUCTION**

Safety is critical when working on or around a drill rig, traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools.

As allowed by copyright, WESTON has adopted the *Environmental Remediation Drilling Safety Guideline* (ERD Safety Guideline) for use on drilling projects. The ERD Safety Guideline addresses environmental remediation drilling and push-probe safety and is an account of work for a collective of environmental remediation industry parties. As stated in the copyright notice for the ERD Safety Guideline, “the authors of this guidance are not undertaking to meet the duties of employers, manufacturers, or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local, state, or federal laws.” Additionally, “the owner of the copyright hereby grants a nonexclusive, royalty-free license to reproduce and distribute this guide subject to the following limitations:

- The document must be reproduced in its entirety without alterations.
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WESTON personnel will use the ERD Safety Guideline in compliance with the copyright notice.

This FLD provides a bridge from Weston's Corporate Environmental, Health, and Safety (EHS) Program to the related processes and forms to be used, and to ERD Safety Guideline information to be implemented, as applicable.

### **Safety during Start-up and Drilling Operations**

The WESTON project manager (PM) and safety personnel are responsible for determining the appropriate procedures to be followed to ensure drilling work is performed safely and must review local, state, and federal laws and regulations that are applicable to each project. If required, client drilling guidelines and/or procedures will be implemented.

Prior to drilling, the PM and field safety officer (FSO) ensure that a site-specific health and safety plan (HASP) and activity hazards analyses have been developed in accordance with Weston's EHS Program. Drill rigs must be operated safely in accordance with manufacturer's operating procedures. General safety information is provided in the ERD Safety Guideline. A Pre-Mobilization Checklist is provided as Attachment 1 and a Drill Rig Inspection Checklists is provided as Attachment 2. Additionally, a Borehole Clearance Review checklist (specifically required on ConocoPhillips projects – other clients may have differing requirements) is provided as Attachment 3 and may be modified for use on other projects.

The FSO observes drilling start-up and operations to ensure adherence to safety requirements. The operator must not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. The drill rig and tools must be used only for the purposes for which they are intended and designed.

### **Utilities**

Safety requirements established in FLD 34 *Utilities* and FLD 35 *Electrical Safety* must be observed during drilling operations. Additional utility safety information specific to drilling activities is provided in the ERD Safety Guideline.

### **Field Safety Officer**

Every drill crew should have a designated FSO (in most cases - the drill rig operator). The FSO has the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to listen to the safety directions of the FSO. The FSO's general responsibilities are established in the EHS Program. Responsibilities specific to drilling include:

- The FSO should understand and communicate that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide the environment to promote and ensure safety.
- Before drilling activities begin, the FSO must ensure that the operator (who may be the safety supervisor) has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- The FSO should inspect the drill rig daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and or damaged pressure gauges and pressure relief valves.
- The FSO should check and test all safety devices, such as emergency shutdown switches, at least daily and preferably at the start of a drilling shift. Drilling should not be permitted until all emergency shutdown and warning systems are working correctly.
- The FSO should ensure that emergency devices are not wire-grounded, bypassed, or removed.

- The FSO should check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds on each starting of an engine.
- The FSO should ensure that all new drill rig workers are informed of safe operating practices on and around the drill rig and should provide each new drill rig worker with a copy of the ERD Safety Guideline or the client's drilling operations safety manual, and, when appropriate, the drill rig manufacturer's operations and maintenance manual. The FSO should ensure that each new employee reads and understands the safety and operations and maintenance manuals.
- The FSO should carefully instruct a crew worker in drilling safety and observe the new worker's progress towards understanding safe operating practices.
- The FSO should ensure that there is a first-aid kit, blood borne pathogen kit, and a fire extinguisher on each drill rig and on each additional vehicle, and ensure that they are properly maintained.
- The FSO (and as many crew members as possible) should be well trained and capable of using first-aid kits, fire extinguisher, and all other safety devices and equipment.

### **Personal Protective Equipment**

For most drilling projects, personal protective equipment (PPE) should include a safety hard hat, safety shoes, safety glasses, and close fitting but comfortable clothes, without loose ends, straps, draw strings, belts, or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry should not be worn during a work shift.

For some drilling operations, the environment or regulations may dictate that other PPE be used. The design and composition of the PPE must be determined jointly by the management of the drilling organization and the FSO. Such equipment might include face or ear protection or reflective clothing. Each drill rig worker should wear noise reducing ear protectors when appropriate. When drilling is performed in chemically-or radiological contaminated ground, special protective equipment and clothing may be required. Additional information regarding PPE is provided in the WESTON PPE Program and in the ERD Safety Guideline. The client may have specific requirements concerning PPE. This must be addressed prior to any work and included in the HASP.

### **Housekeeping and Drill Rig Maintenance**

It is critical for safe field operations that the safety supervisor understands and fulfills the responsibility for maintenance and housekeeping on and around the drill rig. General housekeeping requirements are established in FLD 12 and housekeeping inspection forms are available on the EHS Portal site. Housekeeping and maintenance recommendations specific to drilling rigs are also provided in the ERD Safety Guideline.

Drill rig maintenance must be performed in accordance with manufacturer's recommendations. Safety requirements established in FLD 57 must be observed during vehicle maintenance.

### **Safe Use of Hand Tools**

Numerous and various hand tools can be used on or around a drill rig and in repair shops. "Use the tool for its intended purpose" is the most important rule of proper use. Safety requirements established in FLD 38 must be observed for the specific tools to be used on and around drill rigs.

## **Clearing the Work Area**

Prior to drilling, adequate site clearing and leveling should be performed in accordance with FLD 47 *Clearing, Grubbing, and Logging Operations* to provide a safe working area for the drill rig and supplies. Additional information related to clearing and leveling is provided in the ERD Safety Guideline. See also the Borehole Clearance Guidance attached.

## **Safe Use of Electricity**

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFPA 70-2005 or most current edition) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned to ensure that the work area and operating positions are well lit without shadows or blind spots. The electrical safety requirements established in FLD 35 must be observed during land-based drilling operations. Additional electrical safety information is provided in the ERD Safety Guideline.

## **Safe Use of Wire Line Hoists, Wire Rope, Catheads and Hoists**

The ERD Safety Guideline provides information on wire rope, catheads, and hoisting safety.

## **Safe Use of Augers and Rotary and Core Drilling Tools**

The FSO must ensure that safety precautions and procedures are followed when starting a boring with continuous flight or hollow-stem augers. The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

The operator ensures that special precautions are taken for safe rotary or core drilling involve chucking, joint break, hoisting, and lowering of drill rods. The ERD Safety Guideline provides comprehensive safety information for these operations.

## **Safety during Travel**

The individual who transports a drill rig on and off a drilling site must observe traffic safety requirements established in FLD 20 *Traffic* and guidelines specific to drill rigs provided in the ERD Safety Guideline.

## **Loading and Unloading**

Safety requirements established in FLD 57 for loading and unloading vehicles or other items on a trailer or truck must be observed. Guidelines specific to loading and unloading drill rigs are provided in the ERD Safety Guideline.

## **Off-Road Movement**

The safety requirements related to off-road movement established in FLD 11 should be observed. Guidelines specific to off-road movement of drill rigs are provided in the ERD Safety Guideline.

## **Tires, Batteries and Fuel**

Tires, batteries, and fuel must be inspected or checked in accordance with FLD 57.

## **First Aid**

A first aid kit should be available and well maintained on each drill site. At least one or more members of each drill crew should be trained to perform first aid. Weston's EHSTrack is used to track and identify personnel first aid training. Training should be provided or sponsored by the American Red Cross or a similar organization. For drilling operations, it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin.

## **Drill Rig Alterations**

Alterations to a drill rig or drilling tools should only be made by qualified personnel and only after consultation with the manufacturer. Drill rigs must be inspected after any alterations prior to release for drilling activities. The Drill Rig Inspection Checklist is available on-line on the WESTON EHS Portal Site or through any WESTON safety officer or EHS representative.

# ATTACHMENT 1 PRE-MOBILIZATION CHECKLIST

(Adopted from ERD Safety Guideline Attachment 3.A)

Check When Completed	Checklist of Items
	Participate in boring, utility, locate and walk site
	Verify equipment needs and equipment staging area(s)
	Verify sequence of onsite mobilizations
	Service brakes, including trailer brake connections
	Service Parking (hand) brake
	Service Steering mechanism.
	Service Lighting devices and reflectors
	Service Tires
	Service Horn
	Service Windshield wiper or wipers
	Service Rear-vision mirror or mirrors.
	Service Coupling devices
	Inspect the windshield for cracks, repair or replace as necessary
	Verify that an appropriate, permitted fire extinguisher is within the driver's grasp and that the extinguisher is properly secured.
	Verify supply of sufficient flares or reflectors which can be used in the event of a breakdown while on the highway.
	Verify that seat belts are in good working condition.
	Verify all windows function properly. Repair or replace as necessary
	Verify all doors lock and function properly. Repair or replace as necessary.
	Verify back-up alarms are installed and function properly. Repair/replace as necessary.
	Verify that all lug nuts are properly tightened and that the wheels appear to be in good condition, the spare tire is in good condition, properly inflated, and a suitable jack and lug wrench are available.
	Verify the mast, jacks, deck (s), and tools are completely secured prior to moving the vehicle.
	Verify all tool boxes are closed and properly secured.
	Inspect all spools containing wire rope (cable) and verify they are secured and that the cables will not unwind while driving down the road.

**ATTACHMENT 2**  
**DRILL/DIRECT PUSH TYPE RIG INSPECTION CHECKLIST**  
(Adapted from the ERD Safety Guideline - Attachment 4.B)

SITE/PROJECT NAME: _____	
RIG INSPECTOR (NAME/CO.): _____	
RIG INFORMATION:	
Rig Type:	Rotary/Auger Drilling Rig <input type="checkbox"/> Direct Push Type (DPT) <input type="checkbox"/>
Owner:	_____
Yr/Make:	_____
Model:	_____
VIN #:	_____
Mileage:	_____
Drill Hrs:	_____

***INSPECTOR TO INITIAL COLUMNS BELOW AS APPROPRIATE***

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
<b>Emergency Switches</b>	Kill switches are located and accessible to workers on both sides of the rotating stem. <b>NOTE:</b> Location and number of switches depend on the rig manufacturer, please refer to owner's manual (DPT typically has one switch on control panel).				
	Kill switches installed by the manufacturer are verified to be in operable condition and all workers are familiar with the location and operation of these switches. <b>NEVER BYPASS, DISABLE, OR REMOVE KILL DEVICES.</b>				
<b>Protective Guards</b>	Drive shafts, belts, chain drives, and universal joints are guarded to prevent accidental insertion of hands, fingers, or tools.				
<b>Cables</b>	Cables on drill rig are free of kinks, frayed wires, birdcages, flat spots, grease, and worn or missing sections.				
	Cables are terminated at the working end with a proper eye splice; swaged, coupled, or using cable clamps.				
	Cable clamps are installed with the saddle on the live or load side. Clamps are not alternated and are of the correct size and number for the cable size.				
	Wire ropes are not allowed to bend around sharp edges without cushion material.				
<b>Pulleys</b>	Pulleys are not to be bent, cracked, or broken.				
	Pulleys operate smoothly and freely, without resistance.				
<b>Cable Winches</b>	Motor is mounted in correct location and tightly secured to drill rig.				
	Winch is capable of being placed in the free spool (unwind smoothly) and locked position correctly, demonstrating that the cable is suitable for lifting during drilling operations.				
<b>Safety Latches</b>	Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation.				
	Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load.				

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
<b>Flights/Augers</b>	Flights/Augers should not be bent, cracked, or broken. <b>NOTE:</b> Flights/Augers failing inspection must be removed from jobsite.				
	Flights should be blunt to prevent the risks of cuts.				
	Auger keys should not be bent, have any cracks/fractures, be excessively worn, or otherwise damaged.				
	Auger bolt holes and threads should not be damaged.				
	Inspect flights/augers for metal burrs. <b>NOTE:</b> Burrs must be filed to flat surface.				
	Avoid stacking augers; all should lay flat on ground.				
	Avoid manually lifting/moving augers. Should be lifted/moved with cable lines, or, at a minimum, by two persons.				
<b>Drill String</b>	Drill string should not be bent or have any cracks/fractures.				
	Drill string connecting pins should not be bent, have any cracks/fractures, or be excessively worn.				
<b>Mast</b>	Mast is free of bends, cracks, or broken sections.				
	All mounting hardware (pins, bolts, etc.) should be in place.				
	No moving of drill rig while mast is in vertical position.				
	Maintenance/repairs to be performed on mast only in horizontal position.				
<b>Hammering Device</b>	Hammer free of cracks, fatigue, or other signs of excessive wear.				
	Hammer connections are secure.				
<b>Leveling Devices</b>	Outriggers move in/out and up/down smoothly and freely while using controls on drill rig, with no hydraulic leaks.				
	Outriggers are extended prior to and whenever the mast is raised off its cradle. Outriggers must maintain pressure to continuously support and stabilize the drill rig (even while unattended).				
	Outriggers are properly supported on the ground surface to prevent settling into the soil (use of outrigger support pads).				
<b>Controls</b>	Controls are intact, properly labeled, have freedom of movement, and have no loose wiring or connections.				
	Controls are not blocked or locked into an operating position.				
	Installed lights, signals, gauges, and alarms operate properly.				
<b>Lifting Devices</b>	Slings, chokers, and lifting devices are inspected before using and are in proper working order. <b>NOTE:</b> Damaged units are to be labeled and removed from jobsite.				
	Shackles/Clevises are in proper working order with pins/ screws in place that is to be used while lifting.				
	Cables and lifting devices are not operated erratically or with a jerking action to overcome resistance.				
<b>Hydraulic System</b>	Hydraulic lines are secure, in good condition with no signs of excessive wear, and not leaking. <b>NOTE:</b> Check while pressurized.				
	Hydraulic lines are not in a bent or pinched position causing additional fluid restrictions/pressures.				
	Hydraulic oil reservoir has appropriate amount of oil and not leaking.				
	Documentation available to confirm that pressure relief valve was checked during shop maintenance activity and noted on maintenance log.				

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
<b>Pump Lines (water, grout, etc.)</b>	Suction/Discharge hoses, pipes, valves, and fittings are secured and not leaking.				
	High pressure hoses have a safety chain, cable, or strap at each end to prevent whipping in the event of a failure.				
<b>Fire Prevention</b>	A fire extinguisher of appropriate size is located on drill rig and readily available/accessible for drilling crew (recommended 20 lb.).				
	Documentation available to confirm that the drilling crew has received training on proper use of fire extinguishers.				
<b>Ladders</b>	Drill rig has a permanently attached or proper portable ladder to be used for access to drilling platform.				
<b>Tracks</b>	Tracks on rig are not excessively worn and free of any debris or foreign material.				
<b>General</b>	Drill rig meets regulations for transport on state/federal highways (inspection sticker, license plate, etc.).				
	Documentation available to verify that rig was inspected prior to arriving at site.				
	Does the rig size meet job requirements?				
	Maintenance log available for previous 3 months to confirm proper maintenance/inspection.				
<b>Exhaust</b>	Exhaust system should be free from defect and routes engine exhaust away from drill rig workers.				
<b>Fuels</b>	Fuel stored in an approved and properly labeled container.				
	Fuel transfer lines free from signs of excessive wear and not leaking.				
	Refueling and transferring of fuel is performed in an approved area with sufficient containment to prevent spillage.				
<b>Exclusion/ Work Zones</b>	The exclusion/work zone is centered over the borehole and the radius equal to or greater than the height of the mast (measured from ground level).				
	The exclusion/work zone should be clear of tripping hazards.				
<b>Overhead Obstructions</b>	Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to under, by, or near power lines in accordance with the following: * 50 KV or less - minimum clearance of 10 feet * 50 KV or greater - add 0.4 inches for every KV over 50 KV * If voltage is unknown, maintain at least 20 feet of clearance.				
	While the rig is in transit, clearance from energized power lines will be maintained as follows: * Less than 50 KV - 4 feet * 50 thru 365 KV - 10 feet * 366 thru 720 KV - 16 feet				
<b>Rig Repairs</b>	Repairs, when possible, are conducted offsite to reduce the risk of any onsite incidents.				
<b>Specialized PPE</b>	When working at elevated heights, workers are to wear a fall restraining device attached in a manner to restrict fall to less than six feet.				
	When working in wet/slippery conditions, all workers have a lug-type sole or similar slip resistant sole, on their safety footwear to prevent slipping.				

***RECOMMENDED SPARE PARTS OR ITEMS TO BE SENT WITH DRILL CREW***

<b>DRILL RIG</b>		<b>DPT RIG</b>	
	Emergency Switch		Emergency Switch
	Drive Coupling		Drive Caps
	Shear pins/keys (for drive coupling)		Cutter Head
	Pump Packing		Pull Cap
	Pump Hoses		Liner Cutter
	Auger Bolts		Rod to Cap Pins
	Rod to cap pins		Liner Holder (used while cutting)
	Cutter Head		Spill Kit (5 gal. Bucket with oil dry and absorbent pads)
	Safety Latches, Hooks, Clamps		
	Split Spoon Cutter Head		
	Spill Kit (5 gal. bucket with oil dry and absorbent pads)		

### ATTACHMENT 3 BOREHOLE CLEARANCE REVIEW

Site: \_\_\_\_\_ Project/WO #: \_\_\_\_\_

Date: \_\_\_\_\_

Clearance Inspected by: \_\_\_\_\_ Reviewed by: \_\_\_\_\_

Yes	No	
<input type="checkbox"/>	<input type="checkbox"/>	1. Is a scaled site plan showing the proposed borehole locations attached to this form?
<input type="checkbox"/>	<input type="checkbox"/>	2. Are all of the proposed borehole locations at least 3 feet (or farther as dictated by utility owners and regulation) from any subsurface utilities plans?
<input type="checkbox"/>	<input type="checkbox"/>	3. Are all of the proposed borehole locations at least 3 feet from any subsurface utilities shown on public right-of-way street improvement plans? PM to check here <input type="checkbox"/> if applicable to this job.
<input type="checkbox"/>	<input type="checkbox"/>	4. Does the Facility Manager or on-site representative have any knowledge of any subsurface utilities within 3 feet of the proposed borehole locations? (Review locations with the facility manager or client contact as appropriate).
<input type="checkbox"/>	<input type="checkbox"/>	5. Are all of the proposed borehole locations at least 3 feet from any subsurface utilities identified during a geophysical survey if one was conducted? PM to check here <input type="checkbox"/> if applicable to this job.
<input type="checkbox"/>	<input type="checkbox"/>	6. Have all underground service alert providers (One-Call) marked out their facilities in the vicinity of the borehole locations?
<input type="checkbox"/>	<input type="checkbox"/>	7. Do any of the proposed borehole locations lie on a line connecting two similar looking manhole covers or other utility structures?
<input type="checkbox"/>	<input type="checkbox"/>	8. Do any of the proposed borehole locations lie on a line perpendicular to the street from the water, gas, phone, or electrical service drops or meters?
<input type="checkbox"/>	<input type="checkbox"/>	9. Has the pavement in the vicinity of any of the proposed borehole locations subsided or does it give the appearance it may be covering a former trench?
<input type="checkbox"/>	<input type="checkbox"/>	10. Have you hand augured or post-hole dug a hole or otherwise cleared this location (vacuum excavated, pot holed) to 6 feet below grade before using the drill rig?
<input type="checkbox"/>	<input type="checkbox"/>	11. Is the diameter of the hand augured or post hole greater than the outer diameter of the drilling auger or tools you will be using?
<input type="checkbox"/>	<input type="checkbox"/>	12. Is the soil you encountered in the hand augured or post hole clean gravel, clean sand, aggregate base (gravelly sand with ~10% fines), or non-native looking material? Were there any utility tape or markers found in the clearance hole?

Questions 1 thru 9 must be answered prior to mobilizing a drilling rig to the site. Questions 10 thru 12 should be answered prior to drilling by the field staff. DO NOT DRILL, if you answered NO to questions 1, 2, 3, 5, 6, 10, or 11 or answered YES to questions 4, 7, 8, 9, or 12. Contact your supervisor for instructions and describe the conflict on the back of this form.

## **Borehole Clearance Guidance**

### **Introduction:**

This brief has been developed to assist teams in the process of clearing boring, drilling, probing, or excavating locations prior to initiating the work. For the sake of simplicity and clarity, the term *boring* shall be synonymous with all intrusive work activities, including but not limited to; drilling, probing, auguring, coring, boring, and excavating. It must be understood that subsurface investigation work presents a unique set of challenges and hazards, and it is up to the *entire project team* to fully and properly evaluate the specific circumstances of every boring location prior to initiating the work. The attached check list will help summarize some of the most important parts of what is discussed below.

### **One-Call:**

Teams must check their specific state and local regulations, as well as, any site or client specific underground utility clearance procedures.

### **Clearance**

For the purpose of this brief, clearance means determining if a boring location is safe to advance based on several factors. These factors include:

- The presence of overhead or underground utility structures
- The proximity of the boring to other structures (buildings, roads, infrastructure)
- The slope of the terrain
- Other physical, chemical, biological, and environmental factors

As you can see there are many factors that need to be considered when clearing a location for boring work. A thorough planning session is required to assure that the hazards have been identified and can be controlled prior to advancing borings. The clearance of borings is an ongoing process from initial clearance throughout the implementation phase integrating observations and feedback during the project life cycle. A closer look at hazards follows.

### **Hazard Recognition, Assessment & Monitoring**

Before we can begin to look at the types of hazards we can reasonably expect to encounter during boring work, we must recognize that clearing a boring location is *one step in a much larger process* that continues throughout the implementation phase of the work. Furthermore, on sites where multiple borings or excavations are to be advanced, information gained about the accuracy of utility mark-outs and expectations about subsurface conditions must be refined based on observations and feedback. All too often teams are content when the initial location clearance is completed, forget to revisit this task based on what is confirmed at other locations. A brief discussion of types of hazards we expect to encounter when advancing borings follows:

**Physical Hazards:** The equipment typically used to advance borings is by design heavy and robust. Because we expect to encounter dense materials like asphalt, concrete, glacial till and rock, the tools and

equipment are heavy and durable enough to cut into and through these materials without breaking. That means moving and operating these tools and equipment presents physical hazards associated with lifting, handling, positioning and operating. Care must be taken not to get caught under, or in between these heavy objects.

The locations where borings are advanced are sometimes on sloped surfaces, have overhead or underground obstructions, or may be in tight or tough to get to positions next to or inside of buildings or structures. Care must be taken in getting the equipment into position without exposing the people to contact hazards. Care must be taken to protect existing structures from damage. Care must be taken to protect personnel and equipment from exposure to traffic hazards.

Once the equipment is in place and operating there is typically hazardous levels of noise generated by the equipment so hearing protection is a must. This equipment typically vibrates during operation so it may shift or move while operating. If the equipment is on jacks, blocks or cribbing to level it that structure may become unstable because of the vibration.

During equipment operation there is to possibility that teams may drill, or bore into pressurized or energized utility structures. This is discussed in FLD-34. The equipment itself may have pressurized hydraulic and pneumatic lines as well as rotating, moving or sliding parts. We need to rely on the training knowledge and experience of the boring contractors to keep us aware and protected from these hazards.

Since many boring operations are conducted year round and outside other physical hazards include heat and cold stress.

**Chemical hazards:** Exposure to chemical hazards during boring operations may result from drilling into impacted materials, utility or product line damage, exposure to fumes or vapors from the boring and/or the equipments engine, and finally from exposure to materials and fluids within the boring equipment (fuels, oils, coolants, lubricants, etc.) Additional chemical hazards may be present from the cleaning and decontamination of boring tools and equipment and the chemicals used to preserve environmental samples (acids).

**Biological hazards:** The potential for exposure to biological hazards while conducting borings may exist from contact with injurious plants, animals and organisms (ticks, bacteria, microbes) within the work space or within the boring's cuttings. For this reason skin contact with soiled tools and equipment should be avoided. This topic is discussed further in FLD-43

**Radiological hazards:** The probability of exposure to non-ionizing radiation during boring is likely since most boring operations are conducted outside. However, during the planning and initial clearance evaluation historical site activities as well as conceptual site models for the project site must be evaluated for the likely hood of exposure to ionizing radiation as well.

The very nature of boring operations lends to a large number of potential exposures to hazards of varying type and magnitude, but by and large the potential for exposure to physical hazards are the most prevalent. Do not disregard the possibility of the potential for exposure to chemical, biological, or radiological hazards, but certainly do not under estimate the probability of exposure to physical hazards.

## **Implementation**

Personnel advancing borings, and supervisors of boring teams, need to be vigilant with regard to monitoring the conditions observed at the boring location and comparing the expected conditions with the observed conditions. These conditions include:

- The types of materials (sand, clay, stone, concrete, etc.),
- The expected depths of these materials,
- The expected difficulty or ease of penetration into these materials.

The team needs to have a focus and awareness for precursor and indicators, i.e., any unusual and unexpected situations that occur during the boring work. These observations must be communicated throughout the team so that individuals with unique experience in these situations become aware and can recognize any potential hazards before there are exposures to these hazards. Early hazard awareness and communication are critical components to successful clearance and implementation of boring programs.

The important item to remember here is that things are not always as they appear and there is no substitute for experience, or common sense. Remember to look critically at the facts and keep an open mind.

## **Conclusion**

As mentioned earlier the act of clearing a boring location is the first step in a larger process and observations and feedback must be incorporated into that process as it develops and matures. Please take the time to familiarize yourself with the associated FLDs and work closely with team members to take advantage of their unique knowledge and experience.

## **FLD 64 EMPLOYEES WORKING ALONE**

The purpose of this field operating procedure is to ensure that proper planning, necessary training, and the appropriate controls have been implemented to keep employees safe and prepared for routine and changing site conditions. It is absolutely necessary that documented routine communication by a designated person is made on a regular basis with persons who work alone, for the purpose of ensuring their health, safety, security, and welfare. A worker is considered as "working alone" if the individual is working by his/herself such that assistance is not readily available should some injury, illness or emergency arises.

### **Activity Hazard Analysis Preparation**

An activity hazard assessment (AHA) should be developed prior to employees working alone and should anticipate and evaluate work duration and travel time, weather, primary and secondary communication, type of work, employee medical conditions/restrictions and training. The AHA will address work task associated hazards (physical, chemical, biological, and radiological), and identify specific control measures in order to minimize risk associated with working alone. Additionally, site-specific emergency response provisions should be planned for in the event the employee needs emergency and/or security response support taking into account weather and logistical considerations. High risk tasks will only be conducted when one or more additional qualified workers are assigned to the task. Weston's "Buddy System" is always required in high risk situations to ensure that help is immediately available if an emergency situation arises.

### **Employee Communications**

Evaluate the use of two-way radios, cellular/satellite phones, electronic monitoring devices or another form of direct, reliable correspondence. Select the most effective means of communication and ensure that the employee and designated check person document regular routine and frequent communications based upon the AHA-defined hazards and degree of risk entailed. Where appropriate, workers will be provided with a Personal Locator Beacon with GPS Interface. It is necessary to ensure that the communication device(s) function properly in remote locations.

An individual or job function responsible for check-in with the employee at regular intervals will be designated in the project-specific Accident prevention Plan (APP). Typically, this will be the Safety Officer's responsibility. Provisions must be made to address a backup form of communication in the event the primary modality is unavailable as well as documentation of employee status/wellbeing at the check in intervals. Documentation of check-in should be recorded in the Project Logbook or alternatively appended to the site-specific APP as a log.

If an employee working alone is unable to respond to the contact person at the pre-arranged designated time for reasons other than an accident, the employee must contact his/her Safety Officer no later than 15 minutes after the designated time. Similarly, if an employee working alone knows they will be out of contact at the designated contact time, they are to make alternative arrangements with their Safety Officer within 30 minutes prior to the designated time. When attempts to make contact with an employee working alone are unsuccessful, the Safety Officer is to arrange for an immediate visit to the work area by a member of the Project Team or by local officials, starting from the location at the last point of contact. A verbal or electronic Notification of Incident must be made as soon as practical, but no later than 24 hours from the occurrence, as appropriate, and the necessary steps taken to begin a search for the employee.

# **RADIATION SAFETY**

THE APPROVAL SIGNATURES ARE KEPT ON FILE  
WITH WESTON'S POLICIES AND PRACTICES

Document Number: OP 11-01-022  
Type of Document: Operating Practice  
Effective Date: 12/01/07  
Revision Number: 03

Initiated by: R.P. Schoenfelder  
Legal Review: D.B. Bauer  
Approved by: O.B. Douglass

## **1.0 PURPOSE**

It is the policy of Weston Solutions, Inc. (WESTON®) that all managers and employees will conduct radiological work activities in a manner that keeps radiation exposures as low as reasonably achievable (ALARA), and in compliance with the requirements of WESTON's source material licenses and applicable regulations as specified in Section 2.

WESTON and its subcontractors will take all reasonable precautions in planning and conducting work activities at sites actually or potentially contaminated with radioactive materials to minimize exposures to workers and the public, and to prevent the spread of contamination to the environment. WESTON will maintain this policy by implementing project designs, field engineering controls, administrative exposure limits, and work practices in accordance with guidance provided in this operating practice. WESTON may adopt as policy the recommendations of the International Commission of Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) to the extent that they are consistent with existing corporate policy and regulatory requirements. In addition, WESTON and its subcontractors shall conduct work activities in compliance with applicable Federal, state and local regulations.

This operating practice defines the WESTON radiation safety organization and the administrative health and safety responsibilities of project personnel.

It provides guidance for radiological projects from conceptual design through field implementation. It specifies criteria for complying with regulatory standards, and describes radiological protection program components, guidelines for storage and transportation of radioactive materials, and administrative limits applicable to radiological operations. It is intended to provide uniformity in WESTON's approach to field projects involving potential exposures to ionizing radiation.

## **2.0 STANDARDS AND REGULATIONS**

WESTON and its subcontractors will comply with all applicable Federal, state, and local radiation safety regulations and requirements including, but not limited to, those established by the Occupational Safety and Health Administration (OSHA) and the U.S. Nuclear Regulatory Commission (NRC). Special attention should be given to the regulations listed below. Other requirements may apply at facilities owned or regulated by other Federal departments or state agencies.

- 29 CFR Part 1910, "Occupational Safety and Health Standards."

- 49 CFR Parts 172-174, “Transportation of Hazardous Materials.”
- 10 CFR Part 20, “Standards for Protection Against Radiation.”
- 10 CFR Part 835, Chapter 3 – Department of Energy “Occupational Radiation Protection.”

### **3.0 RADIATION EXPOSURE STANDARDS AND WESTON ADMINISTRATIVE LIMITS**

To ensure compliance with applicable radiation exposure standards, WESTON institutes administrative limits for WESTON employees and subcontractors that are more restrictive than the regulatory limits provided in 29 CFR 1910.1096. These administrative limits are 100 millirem (mrem) per calendar year dose to the whole body from internal and external sources, and 10 percent of the applicable limits for inhalation and ingestion. The applicable limits for inhalation and ingestion will be taken from 10 CFR 20 Subpart C when no other regulatory limits apply. The administrative limits will not be exceeded without prior approvals in accordance with the following provisions:

- Exposures ranging from the administrative limit of 100 mrem per year up to 500 mrem per year and 30 percent of the 10 CFR 20 Appendix B, Table I limits may be approved by the Profit Center Manager or Project Manager only if affected employees have received site-specific training that describes the potential exposure levels and health risks associated with the project or emergency response action involving nuclear, biological and/or chemical materials, appropriate health physics monitoring is conducted under the supervision of a professional health physicist (with appropriate experience), and a task-specific ALARA program has been reviewed by a health physicist and implemented for the project.
- Planned exposures above 500 mrem per year, including emergency response operations that have the potential for exposures up to a maximum of 5000 mrem per year or 3000 mrem per calendar quarter (the maximum radiation dose allowed per 29 CFR 1910.1096), are permitted after a Project/Program-specific Radiation Safety Plan has been developed and reviewed by the Director, Corporate Environmental Health and Safety (CEHS) and/or the Corporate Radiation Safety Officer (CRSO). Weston employees or subcontractors shall not participate in work activities for any duration where the work exposures (dose equivalents) have the potential to exceed 3000 mrem per quarter or 5000 mrem in one year, not even on a voluntary basis for emergency response activities. A Project/Program-specific Radiation Safety Plan provides details as to personnel qualifications, instrumentation, monitoring protocols, personal protective equipment (PPE), respiratory protection, and radiation safety training requirements. It also identifies local/regional professional health physics resources that will directly supervise operations utilizing ALARA principles. Exposures that may approach 5000 mrem per year or high dose-rate environments (e.g., 100 mrem/hour or greater) must be conducted under the direction and guidance of a Certified Health Physicist (CHP), or similarly qualified professional health physicist, possessing relevant experience.
- Documented doses in excess of 100 mrem per year or 50 mrem per calendar quarter without the prior approvals described above must be reported immediately to the Director, CEHS and CRSO. **NOTE:** Exposures in excess of 5000 mrem per year or 3000 mrem per calendar quarter must be immediately reported to the Director, CEHS and CRSO, as well as the NRC or other responsible agency.

- The annual occupational dose limits for minors are 10 percent of the annual dose limits specified for adults. In addition, the dose to a woman who has declared herself to be pregnant must be less than 500 mrem during the entire gestation period. Work activities must not increase exposures to individuals in unrestricted areas above 100 mrem per year. These regulatory and administrative limits exclude exposures due to natural background and medical sources.

#### **4.0 RADIATION SAFETY PROGRAM ORGANIZATION AND RESPONSIBILITIES**

The Radiation Safety Program is administered by WESTON's CEHS Department. The corporate programs are implemented by the Division Managers. The Profit Center Managers and Project Managers implement specific programs and procedures associated with radioactive materials licenses and radiological projects. Individual responsibilities are described in the following subsections.

##### **4.1 Director, Corporate Environmental Health and Safety and Quality Assurance**

The Director, CEHS, has overall responsibility for establishing and managing the programs of the CEHS Department. The CEHS Director's duties in maintaining the Radiation Safety Program include the following:

- Revise this operating practice and radiation safety guidance documents when required to ensure compliance with regulatory changes.
- Develop and maintain supplemental guidance documents for WESTON's radiation safety programs.
- Inform the Division Managers of the Radiation Safety Program requirements, as necessary.
- Organize and manage a central recordkeeping file to maintain the personnel radiation dose records and other data required by this operating practice.
- Approve or deny requests for variances from the guidelines of this operating practice and requests to exceed administrative limits.
- Ensure that radiation safety training is provided to employees as needed, and in compliance with license requirements.

##### **4.2 Division Manager**

The Division Manager is ultimately responsible for implementing the policy and procedures associated with health and safety. The day-to-day management and implementation are normally delegated to the Profit Center Manager or Project Manager.

##### **4.3 Profit Center Manager**

The Profit Center Manager is responsible for approving requests and applications for radioactive material licenses and ensuring that radiation safety programs are established and maintained to ensure compliance with license conditions. Specific responsibilities include the following:

- Sign license applications to indicate the company's agreement to meet commitments described in the application.
- Ensure that license fees are paid in a timely manner.
- Ensure that radiation safety programs, source inventories, personnel monitoring, and inspections are conducted as required by licenses.
- Ensure that documentation and recordkeeping are completed as required by regulations and license requirements.

#### 4.4 Project Manager

The Project Manager is responsible for establishing and maintaining radiation safety programs on projects that involve radiological hazards. Specific responsibilities include the following:

- Develop, approve, and implement a project-specific health and safety plan that describes detailed requirements for the project Radiation Safety Program.
- Ensure that professional health physics support is provided to the project during planning and field activities.
- Document the results of radiological measurements, contamination monitoring, and personnel dosimetry and place them into the permanent project files.
- Provide personnel dosimetry results to the Director, CEHS for inclusion in the corporate database.

#### 4.5 WESTON Employees and WESTON Subcontractors

All employees of WESTON and WESTON subcontractors who work on radiological projects have health and safety responsibilities that include the following:

- Read and become familiar with health and safety plans for projects in which they are involved.
- Abide by applicable radiation safety policies and procedures, and state and Federal regulations.
- Help ensure that their radiation doses and doses received by their co-workers are as low as reasonably achievable.
- Report all unsafe radiological conditions to the Site Manager and suggest improvement in operations to minimize exposures of personnel.

### 5.0 GENERAL REQUIREMENTS

The Director, CEHS maintains guidance documents that provide specific radiation safety program requirements. General guidance for addressing radioactive materials licenses, acquiring radioactive sources, and responding to radiological incidents is provided in the following subsections.

#### 5.1 Licensing, Permitting, and Legal Correspondence

All correspondence that addresses licensing, permitting, or other legal or regulatory matters will be generated and signed by the Profit Center Manager whose operations require the license and are affected by the regulations. The Profit Center Manager is responsible for ensuring that adequate resources are provided to maintain radiation safety programs that will ensure compliance with license requirements. A co-signature of the appropriate Division Manager may also be required where certain commitments of corporate funds or policy are expressed. Copies of radioactive material licenses and related correspondence must be provided to the CEHS Director for maintenance in corporate files.

## 5.2 Purchasing

All purchases of regulated radioactive materials must have the approval of the Profit Center Manager whose operations require the materials. The Profit Center Manager is responsible for ensuring that licenses are acquired and maintained as necessary to allow possession and use of radioactive materials, or that proper precautions are in place for using radioactive materials that may be acquired without a license.

## 5.3 Incident Records and Notification Procedure

Radiological incidents will be handled as specified in the emergency procedures section of the project health and safety plan. The Project Manager will follow corporate accident/injury reporting requirements as specified by the CEHS and Risk Management Departments. Additional notification and reporting requirements will be followed as required by Federal, state, or local regulations.

## 5.4 Transportation, Storage, and Disposal of Radioactive Materials

WESTON and its subcontractors will comply with applicable Federal and state regulations regarding transportation of radioactive contaminated materials. Prior to transport of such materials, the radionuclides and activities involved will be estimated to determine the appropriate procedures and precautions to be followed. Persons shipping or transporting radioactive materials are responsible for ensuring that regulations are met and must comply with Corporate dangerous goods shipping procedures. For more detailed guidance, project-specific requirements will be developed and provided in the health and safety plan.

Radioactive materials will be stored in a manner to maintain exposures to personnel ALARA and to prevent the spread of contamination. Radioactive materials will be disposed in compliance with license requirements and applicable regulations.

## 5.5 Emergency Response

Emergency response procedures will be developed as part of the site-specific health and safety plans to address the radiological aspects of potential accidents, spills, and contaminating events. Procedures will emphasize the importance of containing radioactive materials on the site, and will designate an individual to oversee cleanup activities and conduct contamination surveys in case of a contaminating event. Emergency response agencies will be informed of the radiological hazards that exist at the project site. Guidelines for emergency response will include notification of appropriate regulatory agencies and radiation safety personnel.

# **6.0 IMPLEMENTATION**

The Director, CEHS, or his/her designee, is responsible for interpreting this operating practice.